Evaluation of Chiller Plant Energy Conservation Opportunities at Fort Hood, Texas

by Gerald L. Cler, Alan T. Chalifoux, Kim Parson, and Bruce Higgs

Chiller plant owning and operating costs represent substantial investments at Fort Hood, Texas. Primary objectives of this work are to evaluate the performance of major plants and associated distribution systems, and to identify relevant energy conservation opportunities (ECOs).

Significant effort was expended to gather information and document the performance of plant cooling equipment. Data were obtained from site surveys, discussions with vendors and manufacturers, and reviews of previous studies. Performance was documented with field measurements. Subsequent analyses of ECOs were performed with simplified bin methods consistent with first-order conclusions and recommendations required from this work.

Results for all ECOs were heavily influenced by the utility rate structure. At Fort Hood, 75 percent of annual chiller energy cost is determined by demand charges. Alternatives for chiller ECOs were also limited by the effects of recent regulations that govern the use of refrigerants. Therefore, realistic improvements that reduce chiller energy consumption necessarily involve replacement or major upgrade of most chillers. Other potential ECOs targeted reductions in chiller and pump energy by modulating speed in relation to cooling load. A select group of chillers will benefit from this technology. The higher capital costs combined with the unusually low energy charge preclude speed modulation for all other motors.

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Foreword

This study was conducted for Headquarters, U.S. Army III Corps and Fort Hood with funding by the Strategic Environmental Research and Development Program (SERDP) through the U.S. Army Model Energy Installation Program (MEIP); Thrust Area II, "Central Utility Systems"; Work Element 23, "Central Utility Systems—Cooling." Public Law 101-510 established SERDP as a multiagency program funded through the Department of Defense (DOD) to identify, develop, and demonstrate technologies in the areas of pollution prevention and cleanup, energy and resource conservation and global environmental change. SERDP responds to the environmental requirements of DOD and is undertaken in cooperation with other government agencies, including the Department of Energy, the National Institute of Science and Technology (NIST), the National Oceanographic and Atmospheric Administration, the U.S. Geological Survey, and the National Aeronautics and Space Administration. Bobby Lynn, AFZF-DE-ENV, is the technical monitor; Dr. John Harrison is Director, SERDP.

The work was performed by the Engineering Division (FL-E) of the Facilities Technology Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). The Principal Investigator was Gerald L. Cler. A portion of this work was performed on contract by Bruce Higgs of Wieland, Lindgren and Associates, Inc., Seattle, WA. Larry M. Windingland is Acting Chief, CECER-FL-E, and Donald F. Fournier is Acting Operations Chief, CECER-FL. The USACERL technical editor was Agnes E. Dillon, Technical Resources.

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1 Introduction

Background

Work under this contract was performed as part of the Model Energy Installation Program (MEIP) directed by the U.S. Army Construction Engineering Research Laboratories (USACERL). This 5-year plan was developed to demonstrate the feasibility of large-scale energy reduction programs. Identification of chiller plant energy conservation opportunities (ECOs) was only one aspect of the basewide investigation of possible energy efficiency retrofit opportunities.

Energy conservation opportunities at Fort Hood, Texas, have been evaluated in two known projects within the last 15 years^{1,2}. Large scale implementation of ECOs recommended by those reports^{1,2} was not readily apparent during site investigations. This statement is particularly true for the latter study, which was reviewed early in this project.

Recently adopted regulations governing the use of refrigerants ultimately will create conditions that will force owners of equipment to switch to a chlorofluorocarbon-free (CFC) refrigerant. Many traditional refrigerants are affected by these regulations, and suppliers are ceasing production of CFC refrigerants (see Chapter 3 and Appendix A).

Objectives

This project had three objectives:

- identify ECOs that will reduce energy cost and consumption by 30 percent annually
- identify technologies that will significantly reduce the environmental impact of facility energy operations
- document analysis techniques and methodologies that could serve as a prototype approach for Army-wide application.

Approach

Objectives were accomplished with a combination of site observations and engineering analyses. The initial phase of work, which was oriented toward gathering information, included field surveys to obtain nameplate data and measure performance parameters. Subsequent follow-up contacts with appropriate manufacturers (Appendix B) were necessary to obtain equipment specifications. Most of this information, which included original sales orders and/or catalog cuts, was retrieved from the manufacturers' archives, a procedure that was surprisingly successful, but lengthy. The best available record drawings for mechanical systems were furnished to USACERL from archives at Fort Hood. This process was relatively successful in terms of obtaining drawings for most plants. Some drawings did not reflect remodeling work that took place after initial construction; this was discovered during site observations.

Later phases of work involved documentation and analyses of field measurements and modeling of potential ECOs (see Appendixes A through N). Some manual effort, such as plotting existing pump operating points, was involved. However, due to the wealth of information that could influence conclusions and recommendations, the majority of analyses and modeling were performed with a spreadsheet application specifically developed for this project. Field-measured data were used as input for this part of the work where such data were judged to be valid. Otherwise, typical values obtained from other sources, such as industry publications, were input to proceed with the work. Instances where assumptions or theoretical data may have significant impact are noted. A final scheduled trip that focused on maintenance procedures also occurred midway through this final phase of work.

Scope

Four significant limitations on the scope of this work must be considered. The ECOs that may be available beyond central plant boundaries were excluded from the scope of this study. If such opportunities were observed during site visits, they are noted in text, but were not acted on. Similarly, analyses of the interdependency of ECOs developed during this project will not be performed as part of this project.

Data necessary to establish baseline energy consumption per plant is nonexistent. The best available metering that would include chiller plant loads is located at three substations (one serving Main Fort Hood, one serving West Fort Hood, and one serving North Fort Hood) which serve the entire fort (population 60,000 plus) (Jeff Morton, Robert Nemeth, Jerry Reed, and Bruce Rives, Principal Investigators, U.S.

Army Construction Engineering Research Laboratories, Champaign, IL, professional discussion, 1992 [hereafter referred to as Morton et al. 1992]). Such baseline data would be useful to confirm the absolute accuracy of plant energy consumption simulations contained herein; it would be invaluable to prove or dispute actual energy savings after ECOs are implemented. For large plants that serve housing complexes, this difficulty is compounded by the absence of documented operating parameters, such as fluctuations in local housing populations that occurred during Operation Desert Storm. These fluctuations will continue and become more accentuated as a result of upcoming base closures. Fort Hood will likely absorb a portion of these displaced military personnel, which will obviously impact energy consumption. To help resolve some of these difficulties in electrical consumption and cooling loads, USACERL (in another phase of the MEIP) began to apply the energy disaggragation algorithm (EDA) methodology to determine loads for specific buildings and to disaggregate total energy use into its component end uses.

A part of the work was intended to discover gross savings opportunities using quick and simplified methods. This necessarily implies that special cases could not receive the attention which would be warranted if each case were the only case under consideration. It also implies that, in some cases, engineering judgment may be exercised with greater latitude than detailed research would permit, and that abbreviated calculations would be acceptable in lieu of exhaustive documentation. The intent of the MEIP was to identify, scope, and implement projects within 5 years. Detailed research requires data. As outlined here, detailed data were not available. Generating data takes time. Exercising engineering judgment was the necessary bridge required to get from analyses to project implementation within 5 years.

Unique characteristics of this site must be considered when results presented herein are applied to other locations. The utility rate structure is a prime example. At Fort Hood it is difficult to justify ECOs that reduce energy consumption, without reducing peak demand, because the utility charge for energy consumption represents only 25 percent of the total cost for electricity. An ECO that reduces energy consumption by 33 percent, for example, will reduce energy cost by only 8 percent if peak demand remains unchanged. Weather, operating schedules, and local construction costs are other obvious parameters that will affect ECO payback periods at other sites.

Unrelated to identification of ECOs are issues concerning code violations and unsafe operating conditions. No attempt was made to identify, investigate, or extensively document any code violations.

Mode of Technology Transfer

The findings in this study will support ongoing energy systems modernization research. The results of this study were used to apply for funding to implement the ECOs described herein. The results also will be used to update energy users, particularly at Fort Hood (e.g., they were communicated to Fort Hood maintenance personnel), on an evaluation technique for chiller plants, serve as a baseline document for chillers at Fort Hood, and provide an analysis of chiller plant ECOs at Fort Hood.

Metric Conversion Factors

U.S. standard units of measure are used throughout this report. Conversion factors for standard international (metric) units are provided here.

1 in. 25.4 mm 1 ft 0.305 m 1 yd 0.9144 m 1 cu in. 16.39 cm³ 0.028 m³ 1 cu ft 1 sq ft 0.093 m² 1 sq in. 6.452 cm² 1 ton 907.1848 kg 1 lb 0.453 kg 1 lb/hr $0.126 \, g/s$ 89.3 g/cm² 1 psi 1 psi 6.89 kPa 1 torr 133.322 Pa 6.0 degrees/sec 1 rpm 1 gal 3.78 L 1 gpm 0.06308 L/sec ٥F (°C + 17.78)*1.8 3412 Btu 1 kWh 1 hp .7457 kW

2 Documentation and Analysis of Existing Conditions

Equipment Specifications and Field Measurements

Central chiller plants selected for examination in this study are the same 33 plants examined by Romine, Romine & Burgess, Inc.² in the late 1980s. Table C1 (Appendix C "Chiller Plants and Buildings Served"), documents this information. Trip notes at the end of Table C1 explain field observations that reduced the scope of this project to 29 plants that contain 44 chillers and serve approximately 117 buildings, most of which are located in the central area of the installation.

Tables D1 through D4 (Appendix D) list nameplate and field measurement data for chillers, cooling towers, chilled water pumps, and condenser water pumps, respectively. Table D2, "Chiller Reference Data From EEAP Report," includes pertinent data from the EEAP study² that was used to validate and supplement performance data derived by alternate methods in this study. Comparison of nameplate data included in Tables D1 and D2 indicate that 38 chillers are common to both studies, 3 chillers have been replaced since the EEAP study², and 3 chillers discussed in this report were not included in the EEAP study². This comparison is included on page 2 of Table D1 (Appendix D) under the column titled EXIST vs 88/89. The most important information obtained from the EEAP study² was a simulated cooling load for each plant.

Instrumentation for field measurements included a thermocouple-type thermometer for dry-bulb and water (nonintrusive) temperatures, a sling psychrometer for wetbulb temperatures, a magnehelic gauge for differential air pressures, several water pressure gauges with ranges from compound to 100 psig for differential water pressures, and a clamp-on volt-ammeter with adjustable ranges. Existing gauges either were not used (most did not work properly) or were temporarily removed, if possible, for access to gauge tappings. The only exceptions were factory-mounted refrigerant temperature and pressure gauges and digital read-outs in chiller control panels equipped with such capability. Differential water pressure was measured with a common gauge, where possible, either mounted in a portable manifold or mounted separately for each measurement. Additional measurements were obtained with a

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vibration analyzer and a power/demand analyzer for a select group of chillers during the maintenance observation trip. In addition, the visual condition of most equipment was documented with photographs.

The instrumentation was accompanied by an assortment of basic tools and a complement of spare parts, including gauge cocks, pipe nipples, adapters, etc. Primary obstacles to obtaining necessary measurements were either corroded or mislocated gauge tappings, or there was a complete absence of such ports. Measurement work was temporarily interrupted on numerous occasions to clear plugged ports and, in a few instances, to perform emergency repairs on corroded nipples that disintegrated when wrenches were applied.

Central Plant Performance

The goal of field measurement procedures was to obtain information sufficient to derive chiller outputs (tons) and efficiencies (kW/ton) at known times and ambient temperatures. This information could be used to identify oversized/undersized equipment and establish baselines from which realistic energy savings could be estimated.

Efforts geared toward calculation of actual chiller outputs and efficiencies were not as successful as hoped for. Failure can be attributed to the inaccuracies involved in deriving water flows from pump curves using measured pressure differentials, and using impeller sizes determined from specified operating conditions. This difficulty became apparent when heat rejection ratios calculated for a large number of chillers (heat rejected by condenser divided by heat absorbed by evaporator) significantly exceeded the normal range of 1.2 to 1.3 for typical chillers. Heat ratios are calculated with flow and temperature values. Because values obtained from temperature measurements are relatively error-free, derived flow values were judged to be incorrect.

Combinations of several factors contributed to this problem. Minor inaccuracies are inherent in gauge readings. Mislocated gauge tappings (for example, on the upstream side of strainers) have a similar but more pronounced effect. Pressure readings obtained from tappings on pump flanges also are subject to errors created by nonuniform flow at these locations and, in fact, are not used by manufacturers to rate pump performance. The most significant problem with applying measured pressure differentials to pump curves is that all of the measurement inaccuracies become magnified on pump curves with shallow slopes. The size of most pump impellers in this study was determined from pump curves by plotting specified flow

and head. This method may not accurately predict impeller size for several reasons. One pump manufacturer may trim an impeller to this exact size; another may trim to the next largest undocumented increment of 1/10 in. or 1/8 in. If rush delivery during construction was a consideration, a stock pump, whose impeller size was "close enough," could have been installed. Less common are the possibilities that an impeller was trimmed to a different operating point as part of balancing work, or that the original impeller was replaced for maintenance reasons. Because impeller size is critical in determining flow from measurement of differential pressure, an inaccurate determination of impeller size leads to an inaccurate determination of flow. This difficulty can be overcome, to a large extent, by obtaining a differential pressure measurement at pump shut-off (no-flow). However, this test cannot be performed without disrupting operation of the chillers, and such disruptions were prohibited during the site visits.

Inspection of heat rejection ratios calculated from measured flows and temperatures documented in the EEAP report² indicates that their method of determining flows appears to have been much more successful. Flows in that study² were measured directly by a clamp-on type ultrasonic flow meter. Although proper performance of this device is subject to its own limitations, such as sufficient lengths of straight pipe, this device eliminates all of the difficulties described in the preceding paragraph.

A graphical comparison of flows determined by an ultrasonic meter (EEAP study²) and flows determined by plotting measured pump differential and impeller size (this study) is illustrated by Figures E1 and E2 (Appendix E) for evaporator and condenser water circuits, respectively. In these figures, flows determined in the EEAP study² are labeled "MEASURED," and flows determined in this study are labeled "DERIVED." Plotted points represent the ratio of flow determined by each method, measured or derived, divided by the design flow for that pumping circuit. Design flows were obtained from pump nameplates when possible, or from pump schedules on construction documents. The left-hand portion of both plots may be disregarded (for comparison purposes) because flows from both methods were not available for comparison. Values on the right-hand portion were plotted with ratios for EEAP flows sorted in ascending order for optimum viewing. In addition to the widespread flow problems suggested by EEAP measurements (flow in 76 percent of the circuits falls above or below design value plus/minus 10 percent), these graphs summarize pitfalls of the pump curve approach. Lack of one key piece of information, such as a measured pressure or pump curve, halts the analysis procedure (as far as determining actual load and efficiency) for that entire plant. This occurred in nearly three-quarters of the plants in this study, with condenser flows being the prime offender. Again, this was due to the lack of pressure taps, plugged ports, etc.

The end result of this entire exercise is that actual values for chiller output and efficiency could not be derived from field measurements because the methodology could not account for all potential variables and errors. Therefore, substitute values were used to allow work to proceed. Sources of these substitute values are discussed in Chapter 3 under "Operating Parameters." A revised approach for accomplishing stated objectives in future energy conservation studies is discussed in Chapter 9, Conclusions and Recommendations.

3 Energy Conservation and Economic Considerations

CFC Refrigerant Issues

The impact of recently adopted regulations that govern the use and handling of refrigerants is just beginning to be realized by the majority of chiller owners and operators. Although these regulations allow continued use of existing equipment that operates with an "unfriendly" refrigerant, they ultimately will create market conditions which will force owners to switch to equipment that operates with a CFC-free refrigerant. Tight market conditions are already noticeable, and they will worsen within the next year. Dupont, the largest supplier of unfriendly refrigerants, ceased production of these materials in 1994, and all other production ended by January 1995. Appendix A is a summary of information currently available on CFC refrigerant issues. However, owners should note that new information is issued regularly as the industry reacts, and some manufacturers have been criticized by peers and professional organizations for distributing inaccurate information.

Installation of the first set of R-123 based chillers at Fort Hood was nearly complete in Building 10006 at the time of the first site visit. Consequently, Building 10006 was removed from the scope of this study. Major renovation of nearby Building 9418 also is underway, although the type of chillers planned for this complex is unknown.

A quick review of Table D1 (Appendix D) indicates that 35 of the 44 chillers included in this study operate with three undesirable refrigerants: R-11, R-113, and R-12. It would be unwise and illogical to recommend ECOs for all of these machines to improve performance, and possibly extend their useful life, but retain present refrigerants. The preferred approach would be development of ECOs that allow phased replacement or upgrade of chillers to accomplish both energy- and refrigerant-related objectives. Therefore, a portion of the resources allotted for this study was devoted toward addressing refrigerant concerns. The alternative of replacing most chillers is evaluated in Chapter 5 as ECO-1. Options for conversion or retrofit of existing chillers are discussed separately in Chapter 6. The preferred combination of all alternatives, which is the equivalent of a base master plan for upgrading chiller plants, is discussed in Chapter 9.

Operating Parameters

Design cooling load is a major variable whose value can be obtained from a variety of sources. As discussed in the preceding chapter, actual values for this variable could not be obtained by field measurements in this study due to limitations in the methodology used to derive chilled and condenser water flows. Therefore, another source was consulted, namely the EEAP report².

The EEAP report² documents two potential sources for design cooling loads. One set of loads for almost all plants was available directly from engineering load calculations prepared for buildings served by the plants. Load calculations in the EEAP study² were performed by computer using the "Hourly Analysis Program" (HAP) published by Carrier Corp. This software package is a nationally recognized leader in the industry. Cooling loads (for each plant) obtained by this method are listed on page 1 of Table D2 (Appendix D) for each plant. A second set of design cooling loads can be determined from field measurements of chilled water flow and differential temperature listed in the EEAP report². With measured cooling loads and coincident outside air temperatures from the EEAP study², and profiles of percent full load versus outside air temperature developed in this study, design cooling loads can be determined by extrapolation. Because coincident temperatures were no less than 84 °F, and generally greater than 90 °F, measured cooling loads within this range of outside air temperatures can be extrapolated to design cooling loads at 99 °F outside air temperature with reasonable confidence. Figure E3 (Appendix E) is a graphical comparison of design cooling loads obtained by both the HAP simulation ("H.A.P. CALC") and extrapolation ("PROJECTED") methods. After some debate, HAP loads were chosen as input for this study, primarily because conditions that would qualify the use of measured loads to predict design loads were unknown. For example, if the status of people and lighting loads at the time of field measurements had been confirmed in the EEAP study² to reflect design conditions, extrapolated loads may have been chosen over HAP loads in this study. The difference between loads determined by two methods for each plant translates directly into reduced payback periods because less capital cost is expended for smaller central plant equipment.

Annual hours of operation for each plant are tabulated on page 1 of Table D1 (Appendix D). Based on review of chiller log books, plants are scheduled to operate either year-around or only during the 6-month cooling season. Plants that operate year-around include two training flight simulator buildings, the main hospital, the dental clinic, the commissary, and the post exchange retail store.

Annual load profile quantifies the variation in plant cooling load during scheduled hours of operation for 1 year, i.e., the number of hours per year that a plant will

operate at incremental steps of total capacity. Appendix F outlines the derivation of a profile for a typical barracks building. Plots of annual load profiles normally resemble bell-shaped curves, as shown in Figure F5 (Appendix F). Contours of such profiles are influenced by weather patterns, types of buildings, operating schedules, and all other variables that determine cooling load. The profile shown in Figure F5 (Appendix F) was used for all plants in this study because barracks buildings are the predominant type of connected load.

As is true of the design cooling load, the full load efficiency of existing chillers is another significant variable whose values had to be obtained from alternate sources. In this study, calculations of energy consumption for existing chillers are based on full load efficiencies quoted at the time of purchase. These values are shown in Table D1 (Appendix D). Efficiencies with the suffix "E" denote estimated values that were used because manufacturer's quoted efficiencies were not available.

Using nameplate efficiencies, rather than current operating efficiencies, obviously neglects deterioration due to age and poor maintenance. An example of deterioration in chiller efficiency is discussed in the ASHRAE Handbook of Heating, Ventilating, and Air-Conditioning Systems and Equipment³. Chapter 36 of this handbook³ describes the penalties imposed by excess fouling. For the condenser cited on page 36.7 of this handbook³, fouling sufficient to raise the saturated condensing temperature by 5 °F will increase compressor power by 5 percent and decrease chiller capacity by 3 percent, for a net reduction in chiller efficiency of more than 8 percent. Similar reductions in efficiency are caused by the presence of noncondensable gases in low-pressure (R-11 or R-113) machines. Thus, if actual chiller efficiencies for poorly maintained equipment could have been documented by field measurements, shorter payback periods could have been substantiated by the excess energy consumed by such machines. However, nameplate efficiencies were the best available information that would allow the study to proceed within the time allotted. This approach accomplished the stated objective of identifying cost-effective ECOs. Note that this method erred on the conservative side and did not result in inflated estimations of payback periods.

The full load efficiency of replacement chillers investigated in ECO-1 is listed in Table I8 (Appendix I). Efficiencies for specific chiller sizes required in this ECO are interpolated from quotes of efficiencies for standard chiller sizes listed in Table G1 and shown in Figure G2 (Appendix G). The installed cost for specific sizes of replacement chillers was interpolated from data listed in Table G1 and shown in Figure G1 (Appendix G).

Central plant controls are essentially manual except for standard unloading capabilities normally furnished with chillers and fan cycling and/or bypass controls

installed for cooling towers, many of which were disconnected. Evidence that chilled water or condenser water reset is employed in control sequences was not readily apparent. Because chiller simulations for both existing and proposed machines assume condenser water reset is employed, energy consumption for existing conditions is likely to be underestimated. Also, none of the plants are equipped with variable speed controllers for chillers or chilled water pumping circuits. Therefore, computer modeling of chiller operation for existing conditions was relatively straightforward and could be accomplished with sufficient accuracy using bin-method techniques.

Utility Rate Structure and Incentive Programs

At the time of this study, the vast majority of Fort Hood property was served by Texas Utilities Electric Company under rate schedule GP, General Service Primary. This schedule incorporates standard charges along with clauses that are negotiated on a periodic basis. USACERL analyzed current and proposed rate agreements and determined the unit cost of energy and demand, including the ratchet clause³. This information is shown in Table 1.

Table 1. Utility Charges.

Electric	Charge
Energy	\$0.024/kWh
Demand	\$152.60/kW-yr

This utility offered a variety of demand side management (DSM) incentive programs designed to encourage reduced customer demand and consumption⁴. Of primary interest are rebate incentives for chillers and high-efficiency motors, both of which are offered for new and retrofit applications under the On-Peak Efficiency Improvement Program.

Chiller rebates are offered in tiers based on the type and output rating of the machine. Criteria for chillers of interest in this study are shown in Table 2. Rebates are paid at the rate of \$100/kW reduction (below the base efficiency) for units that exceed the base efficiency, or \$150/kW reduction (below the base efficiency) for units that exceed the bonus efficiency. For a 500-ton, water-cooled, centrifugal machine with a full load efficiency of 0.60 kW/ton, the rebate would be:

Table 2. Chiller Utility Rebate Criteria.

Chiller Type	Capacity (tons)	Bonus Efficiency (kW/ton)	Base Efficiency (kW/ton)
Water-cooled	10-100	0.90	1.00
Reciprocating	101+	0.85	0.95
Water-cooled Centrifugal	101+	0.70	0.80
Water-cooled Screw	10+	0.70	0.80

A similar tiered approach is offered for high- and premium-efficiency motors rated at 3 hp and larger, whereby a base payment of \$100/kW reduction is offered for motors that exceed a minimum standard efficiency, and a bonus payment of \$2.00/hp is offered for motors that exceed a minimum premium efficiency. For motors rated at 300 hp and larger, base payments are limited to retrofit applications only, and bonus payments are not offered. Target efficiencies for base and bonus payments vary according to the size of the motor, and they may be obtained from the utility. Potential rebates available under ECO-4 are listed in Tables L1 and L-2 (Appendix L), ECO-4 calculation of simple payback periods, sorted by pump number and plant number, respectively.

Construction Costs

Estimates of construction costs are included in the appropriate attachment for each ECO. Costs are summarized in the respective table(s) in Appendix I that documents simple payback periods. Cost breakdowns are included in separate tables (see Appendix I) for significant conservation opportunities such as ECO-1.

Cost estimates are based on budgetary-type quotes from equipment vendors for items such as chillers and cooling towers, and generic values obtained from established estimating publications^{5,6,7}. Values from latter sources are adjusted to reflect local market conditions for material and labor as recommended in the publications^{5,6,7}. The estimates were prepared with an abbreviated take-off approach (as is typical of engineering cost estimates) and include contingencies from 10 to 20 percent to account for small costs that cannot be itemized at this time. No overall safety or escalation factors have been applied, nor have design fees or similar soft costs. Costs do not reflect quantity discounts that may be available if upgrades to several plants are combined into one construction project. Columns for total cost do not include credits for utility rebates. The effect of rebates is reflected only in calculation of simple payback periods, i.e., [total cost - rebate]/savings = simple payback.

Costs included for ECO-1 were prepared with standard subassemblies for chillers, cooling towers, and pumps. Chiller assembly costs, for example, include a standard allowance of 20 ft of piping, two valves, two flexible connections, etc. for each water circuit.

Costs for additional materials required for unusual conditions were calculated separately. This method allowed extra costs to be categorized as to should they be included in net payback calculations or only in total project cost. Costs to upgrade mechanical rooms for compliance with refrigerant regulations is one example in which costs are excluded from net payback calculations. If water-cooled chillers are recommended to replace air-cooled machines (for improved efficiency), extra costs associated with the cooling tower and condenser water pump are deemed appropriate for inclusion into net payback calculations. However, if existing towers and pumps must be replaced because existing equipment appears to be undersized or in extremely poor condition, associated costs are included only in gross calculations.

4 Methodology for Simulation of Chiller Operation

Overview

Material in this chapter is included as a focused response toward objective three, to assist in development of a prototype approach for Army-wide application. Readers may bypass this chapter if they are interested only in discussions that relate to specific ECOs at Fort Hood. Additional material that could be used to enhance the approach for future studies is inherently contained in other discussions throughout this report.

Software modules that simulate annual operation of chiller plants to predict energy consumption are available as supplements to most load calculation software packages. The primary difficulty in applying such software to a project of this nature is that resources expended to perform the simulations are inconsistent with the order of magnitude required from the output. Therefore, the spreadsheet template documented in Appendix H was created.

The original version of this chiller simulation spreadsheet template was developed in conjunction with Table G4 (Appendix G), "Payback Comparison of Reciprocating vs. Centrifugal Water Cooled Chillers," which verified the optimum changeover tonnage from reciprocating to centrifugal water-cooled chillers. Revision 1 of this template incorporated algorithms to model a variety of multiple chiller arrangements and was used to create the original version of Tables I1 and I2 (Appendix I). Revision 2, which is documented herein, includes enhancements such as demand-limiting. It was used to update Tables I1 and I2 and to create Table I3 (Appendix I).

Input for Multiple Simulations at One Plant

The template required for each simulation is shown in Table H1 (Appendix H). This template may be copied to successive vertical locations in the spreadsheet, subject to the limitations imposed by the spreadsheet program and its use of conventional memory. With Disk Operating System [DOS (Microsoft Corp.)] versions of Lotus "1-

2-3", for example, between 15 and 20 simulations may be included in one file. Note, however, that processing speed decreases with each additional simulation due to longer recalculation times for larger spreadsheets. Ranges "form1," "form2," and "form3" were created so templates appropriate for the number of chillers in the plant may be copied quickly.

Required input is generally confined to block locations in the header of the template: one block for the plant, and one block for each chiller. For plants that contain up to three chillers on a common piping loop, the first chiller to be energized is labeled "Lead," and subsequent chillers are labeled "Lag 1" and "Lag 2."

Five inputs are available for plant data. Two inputs for identification data are optional, but inputs for "Design Load," "Winter Load," and "Simulation Model" are required. Design load should be the calculated or predicted load at the appropriate design outside dry-bulb temperature. The spreadsheet will calculate energy consumption beyond this temperature up to the last bin of "% Plant Design Load" included in the body of the template. However, chiller output will be limited to its capacity, subject to the load limit setpoint, for bins where chiller load exceeds chiller capacity. Energy consumption for winter operation in this study is confined to continuous operation at the percent of design load specified for "Winter Load" If the specified winter load falls below the minimum step of chiller capacity specified in equations for columns AC, AZ, and BU, 30 percent for constant speed chillers, and 15 percent for chillers equipped with speed modulation, annual hours of operation at minimum capacity are adjusted to reflect cycling. Simple modifications to data in the column "Annual Occurrence Actual" would accommodate other methods of handling year around operation. The same type of adjustment to annual hours of occurrence is included for summer loads because bins of percent full load may fall below the minimum stage of chiller capacity. Input for "Simulation Model" is presently limited to EQ-1, EQ-2I, EQ-2M, EQ-2S, or EQ-3, which correspond to the five sets of algorithms included for various arrangements of one to three chillers in a single plant. Equation set EQ-1 models a single chiller. Equation set EQ-2I is similar, except it models two chillers with independent chilled water circuits in a single plant. Plant load is prorated to each chiller based on input for "Pro-Rated Load" in the cell that would otherwise be used for "Maximum Lead Setpoint" for the lead chiller. Equation sets EQ-2M and EQ-3 model two or three chillers connected in parallel, whereby chillers share the load in proportion to their capacity, while set EQ-2S handles two chillers in series, whereby the lead chiller modulates while the lag chiller is energized in stages.

Specifications for the lead chiller include 11 input labels or values. Input for "Master Chiller Number (Lead)," "Condenser," "Refrigerant," "Status," and "Configuration"

are optional identification-type data. The remaining six inputs are mandatory. Input for "Compressor" is limited to RECIP, CENT, or SCREW, which determines what column of the look-up table (developed as part of the spreadsheet template) are to be employed for part load efficiency data. If W/ TURBO is entered in the cell immediately to the right, the appropriate column in the same look-up table is consulted for chiller performance with a speed modulation controller. Generic-type values are used in the look-up table unless the user elects to input known values for specific machines as described later in this chapter. The look-up table is located in the upper left corner of the spreadsheet and is shown on page 1 of Table H1(Appendix H). Input for "Maximum Lead Setpoint" specifies the percent of full load above which the first lag chiller is energized. If equation set EQ-2I is in effect, input at this location specifies the constant percentage of plant load allocated to each chiller. Inputs for "Load Limit," "Rated Capacity," and "Rated Power" are selfexplanatory, except that algorithms assume input for the load limit is always greater than input for all other control setpoints. This assumption simplifies all equations for multiple chiller arrangements.

Respective input for lag chillers is the same as described here, with one additional input. If equation set EQ-2S is selected, input for "Minimum Lag Setpoint" determines the percent full load at which the lag chiller operates when it is first energized. As plant load increases, the lead chiller modulates toward full load and the lag chiller remains at its initial capacity. When the load on the lead chiller reaches lead setpoint, an incremental step of capacity is added at the lag chiller. Present algorithms for the series arrangement provide initial, intermediate, and final steps of capacity for the lag chiller in a series arrangement.

Equations that simulate staging for each of the five chiller arrangements are presented near the middle of page 1 of Table H1 (Appendix H). For example, equations EQ-2M-1 and EQ-2M-2 for columns Y and AV determine the load imposed on lead and lag machines for two chillers connected in parallel. As the load imposed on the plant increases from zero, these equations specify that the load imposed on the lead chiller cannot exceed that calculated by the product of rated capacity (tons) and maximum lead setpoint (%). When plant load exceeds this value, the lag chiller is energized, and both chillers share the total load in proportion to their rated capacity. Modulation continues up to the load limit specified for each machine.

Equations EQ-2S-1 and EQ-2S-2 for a series arrangement, are similar. In this case, when the lag chiller is energized, it operates initially at a constant capacity equal to the product of rated capacity (tons) and minimum lag setpoint (percent), while the lead chiller carries the balance of imposed load. When increasing plant loads again cause the lead chiller to reach setpoint, the load imposed on the lag chiller is

increased by 50 percent of available capacity, while the lead chiller continues to modulate. This sequence repeats one final time so the load on the lag chiller can reach 100 percent of its capacity. Interested readers may inspect these equations to determine the logic and sequence of operation for other arrangements, or they may view output in Appendixes I and J to gain a similar understanding.

Input for Different Sites or Load Profiles

The body of the spreadsheet template developed to calculate chiller energy consumption for this report contains columns "% Plant Design Load" and "Annual Occurrence Actual." The former column specifies incremental bins of plant load. It does not require modification unless annual hours of occurrence data do not coincide with these bins, or unless different increments are desired. The latter column specifies the annual profile presented by loads served by the chiller plant.

Utility charges are entered into two cells immediately above the spreadsheet template header. This spreadsheet template can be tailored to the rate structure of the local utility, which in this case is very simple. A one-time peak demand determines the annual demand charge, but consumption is billed at a flat rate. If demand charges were ratcheted to a different time period or, more so, if consumption charges were tiered, the changes probably would require a template for each month of the year, with appropriate changes to cost calculation equations.

Execution of Spreadsheet Macros

Execution of two macros is required to complete one simulation after all required data have been input. These macros are shown in Table H1 (Appendix H). Based on input for "Simulation Model," execution of macro "\A," with the cellpointer highlighting the input cell for plant number, copies the appropriate equation set to columns U, W, Y, AV, and BQ to the body of the template for that simulation. Execution of macro "\B," with the cellpointer highlighting the input cell for master chiller number, determines percent of full load power for each bin of chiller load by interpolating within the appropriate column of the look-up table. Interpolation for successive bins continues until values for all cells in one of columns AE, BB, or BW are determined. This macro must be executed once for each chiller in the plant, although some simple modifications could automate this procedure to include all chillers in one execution.

After copying templates for the desired number of simulations in a particular file, worksheet global protection should be enabled to prevent damage that could be caused by inadvertent execution of a macro with the highlighted cell at the wrong location. With this feature enabled, data can be written only to cells that are "unprotected," and such cells were accommodated during creation of the spreadsheet template.

With all required input at hand, simulation of a single plant with three chillers can be accomplished in 5 to 10 minutes, depending on the type of computer and the number of completed simulations already in the file.

Recommendations for Improving Spreadsheet

Part-load efficiency data in the look-up table for reciprocating compressors represents the average performance of six, York, water-cooled chillers reviewed in Appendix G. Because few air-cooled units were included in this study, their part-load performance is assumed equal to the water-cooled type, i.e., their percent of full load power required at each increment of unloading are equal, not the total power required. Values for centrifugal compressors were obtained from the York catalog for one line of their larger chillers. Although there is some variation among all machines, values taken from this catalog are representative for this type of compressor. The partial load performance of screw compressors, of which there are only two in this study, is assumed equal to that of centrifugal compressors. This results in a conservative estimate of screw chiller energy consumption because their part-load performance exceeds that of a centrifugal chiller.

Two known difficulties exist with the look-up table for part-load performance data. Part-load values taken from all sources represent performance with condenser water reset as described in catalog excerpts included in Appendix G. Part-load efficiencies for centrifugal chillers, for example, are based on a $2\frac{1}{2}$ °F reduction in entering condenser water temperature for each 10 percent reduction in chiller load per Air-Conditioning and Refrigeration Institute (ARI) 550-778. The look-up table, developed as part of the spreadsheet template, is constructed to provide part-load chiller efficiencies based solely on percent full load. However, incorporation of reset, based solely on percent full load, introduces inaccuracies for multiple-chiller plants and for chillers that are not reasonably matched to imposed loads. The error for multiple chiller plants occurs because the look-up table is consulted with a percent-of-chiller-capacity value, but it should be consulted with both this value and a percent-of-plant-capacity value to account for the correct entering condenser water temperature for multiple-chiller arrangements. This statement is true because condenser water reset

and percent-of-plant capacity are both related to outside temperatures; percent-of-chiller capacity in such plants is not. A similar difficulty occurs with grossly over-sized chillers. The look-up table inherently assumes, during periods of partial load, that outside air conditions will allow cooling towers to achieve the stated reductions in condenser water temperature. If a chiller is 100 percent oversized, the look-up table will never be consulted with a percent-full-load value greater than 50 percent. Yet there will be periods when the cooling tower cannot produce condenser water temperatures necessary to yield improved efficiencies obtained from the look-up table. The result in both cases is that chiller energy consumption is underestimated.

The inaccuracies described here had minimal impact on the results of this study, so effort was not expended to correct the spreadsheet. The only noticeable impacts occur when a multiple-chiller plant is compared to the same plant operating with only one larger chiller, or when an existing chiller is severely oversized. Because only four instances of such changes were considered in ECO-1, the problem remains to be corrected in future revisions.

The second difficulty with part-load data concerns values in the column for chillers equipped with speed modulation controllers. Percent-of-rated-power values were derived with the pump law that relates capacity and horsepower. Resultant values were then corrected for controller inefficiencies by assuming efficiency deteriorates linearly over the range of the device. These calculations are shown in Table H1 (Appendix H), in the upper center of the page. Although the slope and intercept of the equation that defined deterioration of efficiency are somewhat arbitrary, the addition of a speed control device will penalize overall chiller efficiency as full load is approached. Note that in the look-up table for chillers equipped with turbo-modulators, these chillers require 108 percent of rated power to achieve 100 percent of rated capacity, but 100 percent of rated power produces only 95 percent of full chiller output. This is consistent with actual performance. Comparison of derived values included in the look-up table to other generic sources indicates that values in the table may overestimate the effectiveness of speed controllers on decreasing loads, particularly as chiller loads drop below 50 percent.

Several other improvements could be incorporated into the simulation spreadsheet template to improve accuracy and usability. At present, part-load data for speed controllers represents theoretical values, so actual part-load performance could be obtained from manufacturers and used to more accurately predict performance. Select plants where controllers appear cost effective should be evaluated by the York factory to validate this study or provide information to update this spreadsheet template.

One nonessential improvement to the look-up table would be additional columns to allow modeling of other types of compressors, and perhaps one or two columns for user-defined values. Such changes could be incorporated with minor modifications to the initial instructions in macro "\B".

One change not related to the part-load table may be the inclusion of additional sets of equations to handle unusual chiller arrangements or other sequences of operation. These changes could be included as they are encountered.

A final improvement may be the addition of a minimum load setpoint, below which chiller operation would not be allowed. Present algorithms include a fixed minimum of 30 percent for all chillers except those equipped with a speed modulation controller, where the fixed minimum is reduced to 15 percent. Note that such devices can operate down to 10 percent according to manufacturer's literature. For bins where chiller load falls below these values, the chiller is assumed to cycle on/off at the fixed minimum capacity, so annual hours of occurrence in that bin are adjusted to reflect this condition.

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5 Energy Conservation Opportunities

ECO-1: Replace Chillers

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ECO-1 is an economic evaluation for replacement of nearly every chiller involved in this study. Only four chillers were excluded from consideration in this ECO: two of these are the relatively new screw chillers in Buildings 31008 and 34008, another is the small air-cooled chiller that serves Building 36009, the fourth is one of the two centrifugal chillers in Building 7051.

Regarding these four buildings, base personnel should be advised that it will be difficult to create an enclosure around the chillers in Buildings 31008 and 34008 and maintain space to service all equipment in these mechanical rooms. Isolation, which eventually must occur for compliance with new refrigerant regulations, appears to require relocation of the chillers into new additions created adjacent to each machine's present location to isolate the chillers. The air-cooled chiller for Building 36009 was excluded because it represents a relatively small load, and there is no space in the mechanical room to install a more efficient machine. Base personnel should be aware, however, that the location of this chiller appears to violate ANSI/ASHRAE 15-1992 recommendations⁹ for proximity to building openings. Building 7051 includes two chillers for 100 percent back-up capability. The machine in better condition should be retained for this purpose; the other machine should be replaced as recommended.

Estimates of energy savings and associated construction costs for ECO-1 are provided in Tables I1, I2, and I4 (Appendix I). Estimates of construction costs for upgrading mechanical rooms to meet new refrigerant regulations are shown in Table I5 (Appendix I). Summaries of this information are listed in Tables I6 through I8 (Appendix I). Payback calculations are shown in Tables I9 and I10 (Appendix I), which contain identical information sorted by plant number and payback period, respectively. Tables I8 and I10 (Appendix I) are recommended for a snapshot view and overall understanding of this ECO. Discussions in Chapter 3 outline reasoning that suggests payback periods may be conservative.

The discussion for ECO-1 begins with a section that covers alternate types of equipment considered to improve plant cooling efficiency. Subsequent sections group

the buildings into five categories of chiller replacement options and highlight atypical considerations as appropriate. The last section summarizes results and describes trends between payback periods and plant characteristics.

Analyses of Alternate Chillers and Cooling Towers

Analyses of alternate types of chillers and cooling towers were performed, prior to starting calculations for this ECO, to confirm which types of equipment are most appropriate for various applications at this site. Data accumulated during this effort are included in Appendix G. Several conclusions are worthy of discussion.

Figures G1 and G2 (Appendix G) illustrate installed unit costs and full load efficiencies for five types of chillers that could be recommended to replace existing machines. Tables G2 and G3 and Figure G3 (Appendix G), illustrate the partial load efficiency of water-cooled reciprocating and centrifugal machines. The most striking observation is the soaring unit cost of water-cooled centrifugal chillers as tonnage decreases to manufacturers' minimum offerings of around 100 tons. This fact prompted creation of Table G4 (Appendix G), which is a simple payback comparison of water-cooled centrifugal versus reciprocating chillers ranging in sizes from approximately 125 to 200 tons. The analysis, which included an annual energy simulation for each machine at three different sizes, shows that higher efficiencies of centrifugal chillers, coupled with the significance placed on demand reduction for cost savings, yields simple payback periods from 6.2 years at 125 tons to 3.4 years at 200 tons. The analysis did not account for added maintenance costs associated with centrifugal machines, but it is unlikely such costs would reverse the conclusion that centrifugal chillers should be installed down to sizes at least approaching 125 tons.

A second notable outcome of this investigation results from the same comparison between air- and water-cooled reciprocating chillers. For a fair comparison, unit costs for cooling towers and condenser water circuits must be added to the costs shown in Table G1 (Appendix G) for the water-cooled reciprocating chillers. This adjustment ranges up to \$100 per ton for the sizes under consideration, which places a premium of approximately 10 percent on the installation of water-cooled chillers compared to air-cooled. After accounting for the additional electrical loads of cooling tower fans and condenser water pumps, peak demand created by water-cooled plants will remain at least 20 percent less than the demand created by their air-cooled competitors. In the previous comparison of centrifugal versus reciprocating, the premium to install centrifugal units ranged up to 60 percent, yet they were able to overtake the reciprocating units with respectable payback periods because the centrifugal units held a 20 percent advantage in efficiency. The premium to install

water-cooled over air-cooled in this case is much less severe. Therefore, air-cooled equipment larger than 100 tons should not be installed at this site. Note that smaller sizes were not evaluated.

In spite of the lower efficiency of air-cooled chillers, site visits revealed a trend at Fort Hood to replace water-cooled chillers with air-cooled chillers. This recent trend is an attempt to avoid maintenance costs associated with cooling towers and the poor quality of make-up water. However, for a 100 ton load, the annual savings in demand charges alone would exceed \$4500 for a water-cooled chiller, which should be ample incentive for proper water treatment. Additionally, installing an air-cooled chiller does not eliminate the need for maintenance.

A final comparison, prompted by maintenance required for condenser bundles in open tower systems, involves the differences between open towers and closed towers with evaporative spray capability. The only potential savings to promote closed towers would occur with decreased maintenance for tube bundles in associated condensers. Closed towers protect tube bundles from deterioration caused by poor water quality. A quick review of installed unit costs and connected electrical loads shown in Table G5 (Appendix G) reveals that closed towers fail both comparisons. Installed unit costs for closed towers range from 3 to 4 times greater than open towers, and connected electrical loads range from 2 to 5 times greater. Therefore, closed towers are not an appropriate substitute for better maintenance, and they were not considered for this study.

Categories of Replacement Upgrades

There are approximately five categories of chiller replacements that allow convenient explanation of this conservation opportunity: replace with similar equipment the same size, replace with similar equipment upsized, replace with similar equipment downsized, replace air-cooled with water-cooled, or replace and combine chillers.

Replace Chillers With Same Size of Equipment

This first category covers one-for-one replacement, using the same size of equipment, and includes 12 chillers in the following eight buildings: 5792, 27004, 36000 (3 chillers), 36006, 36014, 39043 (2 chillers), 41003, and 87018 (2 chillers).

Within this group there are a few special cases. Building 36000, the Main Hospital and largest plant at Fort Hood, contains three York R-11 chillers, two relatively new open-drive machines, and one older hermetic that was down for repairs during all three site visits (same problem each time, filled with air). The two newer chillers

meet preliminary screening requirements for conversion to R-123, as discussed in Chapter 6, "Initial Screening for Potential Candidates," so a potential alternative to replacing all three machines would be to convert two machines and install one new machine with sufficient capacity to account for that lost in the conversion procedure. Economics are discussed in Chapter 9, section titled "Compare Replacement, Retrofit, Conversion, and Maintenance Options."

In building 36006, some increased cost will be incurred to relocate the primary chilled water pump, which would free space necessary to isolate the chiller from other equipment in the mechanical room. A similar situation exists in Building 36014; but, in this building, an inactive absorption chiller and its condenser water pump would have to be removed, and the new chiller and other existing condenser water pump would have to be relocated. The new chiller in Building 41003 also would have to be relocated at some additional cost for piping.

For a quick assessment of all buildings where work beyond basic chiller replacement appears warranted, such as those mentioned here, additional costs are categorized in Table I8 (Appendix I). After the corresponding building number is obtained for a particular additional cost, the appropriate detailed table may be consulted to obtain additional insight regarding the nature of extra expenses.

Replace Chillers With Upsized Equipment

The second category of buildings in ECO-1 appears to require upsized equipment to meet estimated cooling loads. This category includes seven chillers in the five buildings: 410 (2 chillers), 14020, 14023, 21002, and 28000 (2 chillers).

A special requirement common to the three single-chiller buildings appears to be the need for a larger cooling tower. Towers in the 14000 series buildings need to be replaced because of their present deteriorated condition. The other two buildings are identical division headquarters facilities that have the only two, site-erected, masonry cooling towers on the post. These highly visible and aesthetically pleasing structures were determined to have sufficient capacity to handle a 10 percent increase in load; no data on their construction was available to calculate their performance limit. The only other additional cost for this group of buildings is expansion of the mechanical room in Building 21002 and relocation of the new chiller to isolate it from other existing mechanical equipment.

To compare new and existing conditions for this group of buildings, additional energy consumption simulations were performed that limit capacities of new equipment to match capacities of existing equipment. Table I3 (Appendix I), shows simulations for

new conditions that include demand setpoints. Results from these revised simulations were used in payback calculations to allow a fair assessment of payback periods for plants in this group.

Note that this is the first category of buildings in which replacement cooling towers are discussed. New towers are included in this ECO only where upsized chillers are recommended, except as noted, or where air-cooled chillers are replaced with water-cooled equipment. For all other existing towers, an allowance (of approximately one-third the cost of a new tower) is included to replace the fill and otherwise refurbish such cooling towers. Most towers need at least some portion of this allowance. In Table I8 (Appendix I), this allowance is flagged by the suffix "A" in the column for additional costs associated with cooling towers.

Two of the buildings requiring upsized chillers, 410 and 28000, contain two chillers each. It may be possible to replace the chiller in the worst condition with a larger, high-efficiency chiller that is able to meet the increased cooling load. This new chiller would be used as the lead chiller by baseloading it. Peak cooling loads would be met by operating the existing chiller in addition to the new chiller.

Replace Chillers With Downsized Equipment

The third category of buildings, which covers one-for-one replacement with down-sized equipment, includes 11 chillers in the following eight buildings: 121, 194, 2805, 7050 (2 chillers), 7051, 29005 (2 chillers), 39015 (2 chillers), and 42000.

For extra costs, Buildings 121 and 2805 appear to require additions to isolate the new chillers and to allow service access for all equipment. Chillers in Building 39015 will have to be shifted several feet to satisfy these same requirements. Piping deficiencies in Building 42000 (e.g., misaligned piping) should be corrected during installation of the new chiller.

Replace Air-Cooled Chillers With Water-Cooled Equipment

The fourth category of upgrades replaces air-cooled chillers with water-cooled equipment. It includes one chiller each for Buildings 50001 and 91001. A third such building is discussed in the next category.

Building 50001, a commissary, presents a challenge regarding placement of the new cooling tower. The two existing condensers are located within a screened utility area (solid concrete wall with bottom openings) that also houses numerous condensing units for coolers and freezers. The condensing units are equipped with discharge

ductwork that, unfortunately, directs hot exhaust air toward the intakes of the condensers. An alternate location is required for any type of chiller heat rejection equipment because there is no suitable space within the screened area.

The new cooling tower for Building 91001 can be installed where the air-cooled chiller is presently located, which happens to be the site of the original cooling tower that served this building. The new chiller can be installed in the same basement location as the original machine, but an isolation enclosure must be created around the new chiller to meet current codes.

Replace and Combine Chillers

The seven chillers in Buildings 135 (two chillers), 5764 (two chillers), and 50004 (three chillers) present three different opportunities to improve efficiency and reduce maintenance by decreasing the number of chillers to one per building.

The upgrade for Building 135 replaces two small reciprocating chillers with a similar, downsized, water-cooled machine. This presents an opportunity to eliminate at least one other air-cooled unit on the opposite end of the building that was not included in this study. The new cooling tower undoubtedly would have to be relocated. Piping modifications would be required to combine the existing independent, chilled-water circuits, and should be considered. This probably could be accomplished with a new primary loop and pump to salvage the existing chilled water pumps and allow the flexibility they provide. The building contains small retail shops that could require different operating schedules.

Building 5764, the Officer's Club, is served by one water-cooled chiller in the basement and a supplemental air-cooled unit, adjacent to but screened from the cooling tower. The second chiller was discovered after all field trips were completed. Drawings indicate that the chillers are connected in parallel, and only one chilled-water pump was found in the mechanical room. Therefore, extra costs for replacement with a single, downsized chiller are limited to a new cooling tower and some extra demolition of mechanical equipment. Both the chilled and condenser-water pumps are assumed to be suitable for reuse with the new chiller.

Building 50004 will require substantially more cost for chiller replacement than most other buildings, but it ranks fifth best in terms of net simple payback and ninth best for gross payback. In this building, three 125-ton, water-cooled, centrifugal chillers are used to met a 306-ton cooling load and should be replaced with one chiller. The three cooling towers are in relatively good shape and can be reused by manifolding their pipe runs just inside the building. The primary reason for increased costs is

work necessitated by refrigerant codes to isolate the chiller. Large air-handling units and overhead ductwork are problems in this mechanical room. The floor area is rather generous but occurs at unusable locations. It appears that the best location for the new chiller would be the same corner of the room where the newest of the three existing chillers is installed. However, the two older chillers, related pumps, and the majority of large piping are all at the opposite end of a long, narrow room. Costs assume that all pumps and a fair portion of the piping will be replaced. A primary/secondary loop that reuses existing chilled-water pumps should be considered.

Results and Trends

Inspection of net payback periods calculated in Table I10 (Appendix I) reveals that two-thirds of the plants have the potential for success in a life-cycle cost analysis. Seven of 26 plants show net simple payback periods of less than 10 years; 10 additional plants follow with payback periods of less than 18 years. If maintenance procedures were improved so new equipment would realize its entire lifespan, upgrades to all of these plants would be justified.

Four of the five largest plants are among the seven with the best payback periods, and capacity reduction seemed only a minor factor for the two of these four in which a reduction is recommended. The fact that all of these plants have mid 1970s Trane chillers is not significant; Trane equipment seemed to be the predominant choice at that time. There was no other correlation between plant capacity and payback period, and correlation between reduction in plant capacity and payback was not strong.

Seven of the remaining nine plants have net payback periods ranging from 21 to 72 years, and upgrades at two plants show negative payback periods. This group of plants with extended payback periods included all four water-cooled, reciprocating chillers recommended in the ECO. Efficiency improvements for this type of compressor were no greater than 8 percent. However, efficiencies used for some existing chillers were only estimates due to the lack of any other data. Building 194 showed negative payback because the method for modeling part-load chiller efficiency with condenser water reset does not account for oversized equipment, and the existing chiller is estimated to be 113 percent oversized (this modeling shortcoming is explained in Chapter 4). When this plant was modeled without reset, energy cost savings changed to \$2609 per year, which yielded a simple payback of 27 years. Building 36006, the other plant with negative payback, contains a relatively new R-11 chiller with a nameplate efficiency of 0.67 kW/ton. When replaced with a new

R-123 chiller, whose efficiency of 0.68 kW/ton is slightly less due to the type of refrigerant, the result is negative payback.

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ECO-2: Install Variable Speed Drives for Chillers

ECO-2 considered variable speed drives for a select group of chillers. Initial qualifying requirements assumed plant capacities in excess of 200 tons, or year around plant operation. Several potential candidates were disqualified because their size fell below this assumed capacity threshold. For reference, Turbo-Modulator Drives can be applied to motors from 150 to 500 hp.

Individual plant simulations are included as Table J1 (Appendix J). A summary of energy costs is included as Table J2, and payback calculations are listed in Table J3 (Appendix J). Eleven of 13 plants show promise of benefiting from installing variable speed chiller drives. Their simple payback periods are all less than 13 years, with five plants showing less than 10 years. The two other candidates that appear to drop out of contention are the plants with existing screw chillers, and this strictly is due to increased capital costs for retrofit installations. When chillers and drives are ordered and installed as a packaged assembly, which was true for the other 11 machines, the cost of including a drive is less than retrofitting a drive to an existing machine. Additionally, these chillers are relatively new and in reasonably good condition. Because screw chillers have good part-load performance characteristics, these chillers should not be considered for variable speed drives.

For reasons detailed in Chapter 4, the performance of chillers equipped with variable speed chiller drives was predicted with derived values for part-load performance. Factory modeling for all subject plants is highly recommended to confirm performance predicted herein. Factory simulations should indicate performance both with and without the drives to minimize differences between modeling techniques and actual cooling loads.

One limitation of variable speed chiller drives must be noted when considering their performance. As chiller speed modulates toward 100 percent, inefficiencies inherent with such drives become noticeable because percent-of-full-load power begins to exceed 100 percent. The crossover point is typically about 95 percent of rated chiller capacity. Thus, to avoid the penalty of increasing demand above the value that would occur without the drive, chillers were modeled with a load limit of 95 percent. If new chillers are selected with rated capacities slightly larger than design loads, the effect of this limitation would be avoided but at the expense of purchasing a

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larger than required chiller; this would add to the initial cost and increase the payback period.

ECO-3: Install Variable Speed Drives for Pumps

ECO-3 attempted to apply the same strategy of speed modulation to existing chilled water pumps, which would become variable speed secondary pumps after plant pumping arrangements were revised. However, this ECO is not feasible due to the increased capital costs for creating primary pumping circuits within the plants and for installing two-way valves and associated controls at each remote building (or cooling coil for smaller plants) to throttle secondary flow. In addition, this ECO will not reduce demand charges, which account for an estimated 60 percent of pump operating costs.

Informal calculations for Building 39015, the second largest plant on the base, are included as Appendix K. An estimated savings of \$7,000 per year was predicted using several assumptions that err in favor of inflated savings. Calculation of pump energy consumption for the new condition assumed that both the primary and secondary pumps were equipped with variable speed drives. However, the new primary pumps cannot realize this savings because they must operate at full load at all times. In addition, energy consumption for the new condition was calculated with pump laws; this calculation does not account for inherent inefficiencies in variable speed drives. Realistic savings with more sophisticated calculations could reduce savings to \$5,000 or less per year. Capital costs within the plant were quickly estimated to exceed \$57,000. Capital costs at 18 secondary/tertiary loop connections would be at least \$2,000 each, depending on the size and quality of the two-way valves. Material costs alone for pressure-independent valves and associated controls (best quality and performance) would be \$2,000 per building. With appropriate contingencies, simple payback periods range upward from 15 years. Therefore, no further consideration was given to this ECO.

ECO-4: Replace Fan and Pump Motors

This conservation measure involves replacement of standard efficiency motors with high- or premium-efficiency motors. It can be implemented in one of two ways: with a wholesale motor change-out as considered herein or with individual motor replacements that naturally occur over the life of such equipment. Payback periods shown in Table K1 (Appendix K) for individual pump motors indicate that wholesale replacement appears warranted, although it is marginal for some motors. Calcu-

lations were not performed for cooling tower fan motors; but, because these motors do not operate continuously and labor costs will be slightly higher to replace fan motors in most towers, wholesale motor replacement is not recommended for cooling towers. However, high efficiency motors should be used when normal replacement of motors is required.

Energy consumption for pump motors is based on the operating point plotted from flow data contained in the EEAP report². A large number of pumps could not be evaluated for numerous reasons, but the remaining pumps provide a representative sample from which conclusions can be drawn. Efficiencies for existing motors were obtained from nameplates or data provided by motor manufacturers. Efficiencies for new motors were obtained from a database of high-efficiency motors available from the Washington State Energy Office*. Payback periods include the effect of the local utility rebate. Every replacement motor selected from the database qualified as a premium-efficiency motor, which increased rebates by \$2.00 per horsepower.

Two items should be included to end this discussion. Figures E1 and E2 (Appendix E) document the large number of pumping circuits that are flowing at less than 90 percent of design values. When flow in these circuits is corrected, energy savings from high-efficiency motors will serve to buffer only an overall increase in energy consumption. Also, current policies or procedures for obtaining replacement motors suggest disregard for the incremental cost of obtaining high-efficiency motors. Utility literature⁴ cites payback periods from 1 to 2 years for conditions in which the motor would be replaced for any other reason. Few replacement motors observed during site visits were the high- or premium-efficiency type.

ECO-5: Implement Demand Limiting

The economics of this opportunity were not quantified because implementation depends on subjective judgments about what setpoints and resultant indoor conditions will be tolerated by building occupants. Human nature guarantees that initial reactions to implementation will be unfavorable. The first observable symptom will be friction between the building occupants and maintenance personnel, whose probable (and understandable) response will be to disable any controls that are creating the problem. The prime motivation for good maintenance procedures is that complaints are reduced or eliminated if ample cooling is provided. If

^{*} An inventory of motors, their efficiencies, and prices was first published in 1991, and updated annually thereafter; Motormaster Database, developed by the Washington State Energy Office, Olympia, WA; phone, 360-956-2000.

implementation of demand limiting was suspected of creating complaints due to lack of cooling, it is likely that limiting setpoints or devices would be removed.

If demand limiting causes no occupant complaints, implementation costs of demand limiting will be minor compared to potential savings because the spine of a basewide energy monitoring and control system (EMCS) is currently being installed. All new chillers should be purchased with the capabilities to interface with the EMCS. Options for remote input should cost less than \$1000 per chiller and are becoming standard equipment with some manufacturers. The remainder of the installation should include no more than 100 ft of communications cable per chiller to link them to interface panels of the basewide utility control system (UCS).

Savings in demand charges can be calculated readily for any demand setpoint. For example, each 1 percent reduction in demand for a 1000-ton plant operating at 0.6 kW/ton results in a savings of \$916 per year. The simple payback period for such a reduction would be less than 2 years. Thus, realistic setpoints, such as a 95 percent demand limit, would have payback periods measured in months.

ECOs Beyond Central Plant Boundaries

Several conservation opportunities with virtually no capital cost exist in remote buildings. The most obvious are rows of open windows in barracks buildings where some occupants complain of being too cold, while ambient temperatures are above 90 °F. The air-side systems are in dire need of repair and balancing. The payback period for making these corrections would be several months.

While spot-checking remote buildings to confirm types of primary/secondary loop connections, a number of air handlers in barracks buildings were observed to be operating on 100 percent outside air. The primary culprit was loose or missing set screws in damper linkage hardware. These conditions could have been created by poor maintenance, or by the resident's desires for improved ventilation. Again, payback periods would be several months.

6 Chiller Conversion and Retrofit Options

Primary Options

Four primary options are available to change from CFC-based chillers to CFC-free operation: refrigerant conversion, driveline retrofit, and replacement of the entire machine, either immediately or at the end of the chillers useful life. The replacement options, which are addressed as ECO-1 in this report, are self-explanatory and require no discussion in this chapter, except for interim measures that should be implemented for delayed replacements. Therefore, the focus of this chapter is the need and procedure for considering the conversion and retrofit options.

As explained in Appendix A, the need to change to CFC-free chiller operation is actually an implicit requirement that results from regulations which ban production of CFC refrigerants after 1995. Continued operation of CFC-based chillers is acceptable subject to limitations on the quantity of refrigerant that legally can be discharged to the atmosphere (15 percent of system charge annually). Therefore, owners can operate CFC chillers until their private refrigerant inventories are depleted, until such refrigerants are no longer available from market sources (i.e., companies that recycle used CFC refrigerants), or until the latter option becomes cost-prohibitive. When all refrigerant sources are expended, owners must change to CFC-free chiller operation or they will be unable to provide refrigeration-type cooling.

Owners who are contemplating chiller replacement in the short-term future should be aware of the potential for a severe shortage of such equipment. Maximum production capacity of the major chiller manufacturers, for machines 200 tons and larger, is estimated to be 6500 chillers per year. Of this amount, 4000 units per year are expected to fulfill the requirements for new construction; the remaining 2500 units per year appear to be available to replace existing equipment. Recent CFC regulations will affect an estimated 80,000 existing machines. Obviously, there will be a shortage of new machines for owners who select the immediate replacement option. Therefore, owners must be prepared to consider nonreplacement options: refrigerant conversion or driveline retrofit.

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The likely shortage of new chillers is only one of several reasons why owners should consider conversion and retrofit options. Owners of relatively new machines may discover that a simple conversion is appropriate for their equipment at a fraction of the cost of a new chiller. This would be true especially if gaskets in these newer chillers happened to be, and quite possibly are, compatible with non-CFC refrigerants. Other owners may learn that a driveline retrofit will increase operating efficiency, again at less cost than a new machine. The likelihood of this benefit increases if a downsized replacement compressor can be coupled with existing tube bundles that have surface areas in excess of those required to meet the cooling load.

Detailed investigation and analysis of all information required for conversion or retrofit options are beyond the scope of this energy study. Preliminary recommendations contained herein for conversion or retrofit are based on a preliminary screening to determine the most likely candidates for these options. The next step in the evaluation of candidates involves on-site investigation and testing of specific components by trained service personnel and design calculations and selection of replacement components by factory engineers to certify the performance of upgraded equipment. At these stages of the process, each machine must be studied individually-generalizations are no longer appropriate. As such, these steps represent an investment of time for which compensation may be warranted. Manufacturers typically charge a nominal fee for engineering work associated with certifying upgraded performance. If the owner elects to pursue that upgrade, this charge is often credited against the cost of new components. This report does not certify the potential for nonreplacement options, nor does it include an exhaustive list of such options. Instead, this report favors a simplified approach to cover the range of possible alternatives and, as such, should be considered as the initial draft of a plan to cope with CFC issues.

Conversion and retrofit opportunities identified during this study are based, in part, on information provided by Natkin Service Company (Seattle, WA branch). This firm is an independent, nationwide, contracting firm with considerable experience servicing all major brands of chillers. Information also was provided by York International Corporation, which is the unquestioned leader among major manufacturers in this relatively new aspect of the chiller industry.

Other manufacturers still are developing their approach toward converting and retrofitting existing chillers. Their experience is limited and typically applies only to their own equipment. Representatives at the Trane factory declined to participate in the conversion/retrofit aspect of this project, stating that their engineering staff was overloaded with projects of this nature. Local Trane sales representatives will

be charged with handling initial calls concerning refrigerant-related upgrades as soon as they can be properly educated.

York, however, offers conversion and retrofit packages for chillers of nearly every type and manufacturer, and it has a record of successful installations that predates the CFC-free chiller issue.

Carrier's policy is to avoid all but new installations of their equipment. However, they are advertising a "Chiller Operation Assurance Program" which promises owners that their existing R-11 chiller will operate until the year 2000 or Carrier will replace the machine free of charge. To qualify, owners must equip their machines with Carrier refrigerant conservation devices and enter into a Carrier service agreement.

Initial Screening for Potential Candidates

Initial screening of existing chillers, to determine the need and type of CFC-free chiller upgrade, followed a logical analysis of plant requirements and chiller nameplate and performance data. Steps included the following:

- Note type of refrigerant. Consider upgrades for all CFC-based chillers.
- Compare actual or estimated peak cooling load to rated capacity of existing equipment. Note whether upsizing is required or downsizing may be appropriate.
- Note manufacturer, model number, production date, type of compressor and drive, and pressure rating of shells. Determine whether refrigerant conversion appears feasible, if driveline retrofit appears available, or if chiller replacement is the only possible solution.
- Conversions and retrofits are not considered for reciprocating compressors and should not be considered for extremely old equipment (30 years or older).
- For relatively new chillers (10 years or younger) or for York chillers in general, if conversion appears feasible, retrofit may not be necessary unless the peak cooling load exceeds post-conversion capacity. At that point, other ECOs to reduce cooling loads may be more cost effective, i.e., lighting retrofits save energy directly and reduce cooling loads.
- For potential conversion and retrofit candidates, eliminate candidates whose
 post-upgrade cooling capacity will be less than the estimated cooling load,
 consider other energy conserving methods to reduce cooling loads, or relocate
 machines if they can be used successfully elsewhere.

- For remaining conversion candidates whose manufacturer is out of business or has become part of another company (Westinghouse for example), consider the future availability of spare parts.
- For remaining retrofit candidates with multistage compressors (typically Trane), consider the difficulties in obtaining a suitable replacement compressor. Design philosophies for optimizing compressors or tube bundles differ among manufacturers. Trane tends to concentrate on sophisticated compressors, and York appears to focus on optimizing tube bundles. Thus, compressors are not always interchangeable between manufacturers.

Tables M1 and M2 (Appendix M) present results of the initial screening of major chillers at Fort Hood. The tables contain identical information but list data according to different sorting criteria for ease of use and understanding. Information in the left-hand portion of Tables M1 and M2 (Appendix M) represents some of the most relevant data that must be reviewed in the initial screening. The right-hand portion of Table M1 (Appendix M) represents assessments based on the best available information. The right-hand section of Table M2 (Appendix M) shows similar types of assessments furnished by York International Corporation and Natkin Service Company, a manufacturer and contractor, respectively.

The costs shown in Tables M1 and M2 (Appendix M) for eddy current testing represent an average cost per chiller, without regard to chiller size or other characteristics. The grand total cost for testing is a realistic value based on a scenario developed by Natkin Service Company with actual tube characteristics for each machine. Qualifications furnished with Natkin's grand total estimate specified that one head shall be removed from each machine, and that all tubes shall be cleaned prior to the start of testing work. Worst case scenarios were assumed, so some cost savings could be realized if all chillers in any plant could be tested at the same time.

Costs for new rupture disks and high-efficiency purge units would apply only to machines scheduled for delayed replacement. These devices are intended to minimize the loss of refrigerant in the event of an over-pressure emergency discharge, or during normal purge cycles for low-pressure machines. Current styles of high-quality rupture disks are designed to reset when system pressure falls to 90 percent of the maximum allowable pressure within the chiller. Older style disks (standard carbon bursting design) are not reusable and allow complete discharge of all refrigerant in the machine. High-efficiency purge units employ improved condensing techniques to reduce the ratio of refrigerant-to-air released to the atmosphere during normal discharge cycles.

Costs to upgrade each machine correspond to the type of upgrade listed in the right-hand columns of Tables M1 and M2 (Appendix M). Ratios of upgrade cost to replacement cost compare the upgrade cost listed in this table to the cost of a chiller sub-assembly listed in Table I8 (Appendix I). Note that ratios for simple conversions, for which six candidates are identified, range from 15 to 20 percent of the replacement cost. Retrofit costs for the remaining low-pressure candidates range from 50 to 80 percent of the installed cost for a new machine, with a number of candidates at less than 60 percent. None of the R-12 chillers appear on the candidate list, primarily because most are Westinghouse units and York, the only potential supplier, cannot provide a retrofit compressor for these machines.

Additional Steps To Confirm Feasible Upgrades

Initial screening is the practical extent to which owners of chillers can realistically participate in the upgrade process. Beyond this point, their participation is necessary to fund testing procedures and is strongly recommended so they can make informed decisions. Personnel responsible for operation of chiller plants at Fort Hood should begin contacting engineering consultants, chiller manufacturers, and qualified refrigeration contractors to proceed with the following work:

- Evaluate physical condition of components, in terms of performance and compatibility with alternate refrigerants, and perform applicable tests. An eddy current test to determine the condition of evaporator and condenser tubes is mandatory. Leak detection, vibration analysis, and full-load tests should be performed for conversion candidates, as should a complete checkout of all other mechanical and electrical components.
- Identify components that must be replaced.
- Certify expected performance after upgrade, including cooling capacity (tons) and operating efficiency (kW/ton), and compare to performance of a new machine.
- Estimate cost of upgrade and compare to cost of a new machine. Confirm that life-cycle cost of upgrade is acceptable.
- Initiate upgrade or purchase a new machine. Include related work necessary
 to upgrade mechanical room to current code requirements and, when appropriate, piping modifications to improve "system" performance.

7 Maintenance Procedures

Existing Conditions

Maintenance procedures received a dismal appraisal in the EEAP report², based on site visits performed in the late 1980s for that study. If sincere effort had been put forth since then to correct the kinds of deficiencies the report² documented, noticeable improvements should be evident by now. Judging from physical appearances alone, maintenance procedures have not improved. In fact, they may have deteriorated enough that the opportunity to perform maintenance does not exist. Emergency response would seem to characterize the present situation accurately in many of the chiller plants visited during the course of this study.

Examples of the variety of equipment difficulties witnessed during site visits should be documented. Beginning with the chillers, seven machines were operating with load limits set below full capacity, the lowest setpoint of 60 percent was found on the lead chiller in Building 39015. These limits are set because the machines are not capable of performing at peak output. Control panels for the chiller in Building 36006 and for one of the three machines in Building 36000 indicate excess purge cycles, which is a basewide difficulty. As mentioned previously, another R-11 chiller in Building 36000 had been out of service for months because it was filled with air. The chiller in the basement of Building 5764 was low on charge. There were empty cans that would hold 1700 lb of refrigerant stacked next to this chiller, and its charge is 500 lb. When the chiller in Building 121 was tested to full load, its low temperature cut-out tripped, which indicated low charge or water flow. Some machines that showed signs of recent repair were reassembled and sealed with what looked to be "home-made" gaskets. It is doubtful that all of these chillers could have developed problems of the severity noted here since the end of the winter maintenance season.

Although chiller log books are not an item of equipment, they deserve special mention due to their importance in diagnosing the performance of chillers. The log books at Fort Hood contain entries for date, time, name, oil temperature or pressure, and an occasional description of a maintenance event. Entries limited to this extent are essentially useless. A properly completed chiller log sheet should contain at least two dozen items of information such as entering and leaving water temperatures and pressures; suction and discharge temperatures and pressures; condensing pressure,

corresponding temperature, and actual temperature; oil pressure and temperature, amp draw, setpoint, etc. In addition, the log book should contain these same values at full load conditions, as stated by the manufacturer, to provide a reference point for comparison with actual values.

An example illustrates the value of recording these values and understanding what they mean. Assume measurements taken on a typical R-11 chiller include a condensing pressure of 13 psig measured in the shell and a condensing temperature of 105 °F measured in the liquid line leaving the condenser. From standard refrigerant tables, the saturated temperature corresponding to 13 psig is approximately 110 °F. The 5 °F temperature difference between the corresponding and actual condensing temperatures indicates a problem (1 to 2 °F normally is acceptable). In this instance, the condenser probably contains air or noncondensables that create a loss in efficiency because compressor discharge pressure is higher than required.

Cooling towers, which offer little challenge in terms of maintenance, show signs of widespread neglect. Of the 19 towers known to have bypass-valve control, the valves for at least 11 towers were "frozen" in position, disabled, disconnected, or otherwise inoperable (some had disconnected actuators dangling in place). Excessive vibration was observed in three towers. Make-up water for one system appears to be fed manually through a hose connected to the blow-down valve of the pump strainer. Most noticeable, however, are mineral deposits on fill material. Some of these deposits are at least one-quarter inch thick. The majority of towers require attention for this problem and, to a lesser extent, for excessive biological growth.

The most revealing observation, however, is the overall physical appearance of the equipment and mechanical spaces, leaking pumps, valves, and fittings and old equipment (pumps and controls) left laying in the corner of mechanical rooms when repairs were completed. This evidence is significant because it reflects the prevailing attitude. If allowed to continue unchecked, this attitude may destroy attempts at energy conservation.

Refrigerant Consumption

Table 3 is a copy of the best available record of 1993 refrigerant consumption at Fort Hood. USACERL is attempting to track the flow of this material through various maintenance shops so, at this point, the amount of each refrigerant consumed by chillers in this study is unknown.

Refrigerant	Vol./Wt	# Cans	Total used	\$/Can	\$/Ib	\$ Total
R-11	55 gal	79	4,345 gal	696.00	1.02	54,984
			(~53,850 lb)			
R-12	30 lb	1970	59,100 lb	223.00	7.43	439,310
	50 lb	742	12,100 lb	370.00		89,540
R-22	30 lb	698	20,940 lb	46.35	1.54	32,352
	50 lb	148	7,400 lb	75.60		11,189
R-113	100 lb	13	1,300 lb	736.00	7.36	9,568

Table 3. Fort Hood refrigerant usage for the 12 months ending May 10, 1993.

Two of the refrigerants listed in the record, R-11 and R-113, have limited application beyond central plant chillers. Although analysis of their consumption is necessarily speculative at present, such an analysis would illustrate an important point. The total charge of all R-11 machines in this study is approximately 16,500 lb. At the legal discharge rate (for space conditioning operation) of 15 percent of system charge annually, 2475 lb per year of this material could be discharged to the atmosphere before the U.S. Environmental Protection Agency (USEPA) could begin investigation of the problem. The inventory shows that 53,850 lb of R-11 was consumed during the 12-month period of record. If all R-11 consumed during this period could be traced to these chillers, the resulting consumption rate would exceed the legal limit by a factor of 22. Similar calculations for R-113 yield a factor of 4. If a substantial number of additional users is not identified, the magnitude of these consumption rates is a serious problem, both legally and economically because availability of these refrigerants is declining and cost is increasing.

At the time this study was undertaken, the cost of this problem could not be included in payback calculations for reasons discussed here. However, if the analyses in the preceding paragraph were applied to costs, the savings would amount to \$2900 per year for each R-11 chiller and \$1900 per year per chiller for R-113. The unit cost for the R-12 chiller probably would be similar. However, there are a host of other probable users, including refrigerators and freezers for food, so the total cost for consumption of R-12 cannot be attributed to chillers alone. Additional discussion of the refrigerant use is given in Chapter 8.

Alternative Approaches

Natkin Service Company estimates (personal communication) that a crew of two journeymen, two helpers, and one lead refrigeration mechanic could adequately service the chillers and related equipment included in this study. The number of

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civilian employees that presently maintain these chiller plants is unknown, but it is not less than five. Therefore, a problem exists and alternate solutions are available.

Private service contracts are one potential approach to restore respectability to operation and maintenance of central plant equipment. Implementation could be tailored to several objectives. If unqualified personnel are contributing to the problem, the contract could be arranged to supplement the current staff and provide on-the-job training. Training should begin with preventative maintenance procedures and move toward predictive procedures. Vibration analysis, for example, is used successfully elsewhere to predict and avoid more costly repairs that ultimately will be required.

Lack of incentive and motivation are evident problems that may be reversible through competition. Contracts for total maintenance of a select group of plants could be arranged so their annual performance can be judged against comparable plants maintained by present staff. This arrangement would be unusual but probably enlightening.

Third-party ownership and operation with shared savings is another possibility. This arrangement could be incorporated into the plant upgrade projects, whereby contractors would bid to provide cooling capacity for some time period, and they would remain responsible for operation of the plant after construction. This concept may be applied successfully to the large stand-alone plants.

As mentioned previously, life-cycle cost savings will never be realized if the quality of maintenance remains at present levels.

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8 Chiller Inventory and Refrigerant Use

In March 1993, USACERL personnel surveyed all readily located, air-cooled chillers at Fort Hood. This survey covered 514 air-conditioning units. Its intent was to identify and categorize air-conditioning equipment not covered in the MEIP study of central plant chillers. USACERL personnel gathered available nameplate data and supplemented this with manufacturer's data. USACERL personnel surveyed a representative sample of each building type (e.g., barracks, administration, and recreational facilities). Due to the short time and unavailability of equipment to test the units for actual refrigerant charge, USACERL considered nameplate refrigerant charge values to be correct. This survey was then combined with an earlier EEAP study² to cover a total of 554 units.

The units ranged in size from 2 to 645 ton capacity. Of the 554 units, 27 units were under 5 ton capacity, 366 units were between 5 and 25 ton capacity, 100 units were between 26 and 100 ton capacity, 25 units were between 101 and 200 ton capacity, 16 units were between 201 and 500 ton capacity, 7 units were over 500 ton, and 13 units had an undetermined capacity. The total cooling capacity of the units surveyed was 15,616 tons. The surveyed units in each capacity range break down into the following percentages: 5 percent of all units were under 5 ton, 66 percent were between 5 and 25 ton, 18 percent were between 26 and 100 ton, 5 percent were between 101 and 200 ton, 3 percent were between 201 and 500 ton, and 1 percent were over 500 ton capacity (Figure 1)*.

These percentages do not show the total impact of the number of units on total cooling capacity provided by each group. The 27 units under 5 ton, 5 percent of the total number of units, provided only 0.36 percent of the total post cooling capacity. The 366 units between 5 and 25 ton, 66 percent of the total, provided 18 percent of the total cooling capacity. The 100 units between 26 and 100 tons, 18 percent of the total number of units, provided 23 percent of the total post cooling capacity. The 25 units between 101 and 200 ton, 5 percent of the total number of units, provided 15 percent of the total post cooling capacity. The 16 units between 201 and 500 ton, 3 percent of the total number of units, provided 26 percent of post cooling capacity. The 7 units over 500 ton, 1 percent of the total number of units, provided 17 percent

Figures are at the end of the chapter.

of the cooling capacity. Even though the units over 100 tons only accounted for 9 percent of the total number of units, they provided over half (58 percent) of the total cooling capacity surveyed. The breakdown of total post cooling capacity provided by air-conditioning units in each size range is shown in Figure 2.

An important issue to consider is the amount and type of refrigerant used in each of the four different capacity ranges. The total amount of refrigerant used in all the units surveyed was 53,919 lb. Of this amount, 21,981 lb (41 percent) was R-11, 21,708 lb (40 percent) was R-22, 7,207 lb (13 percent) was R-12; and 3,203 lb (6 percent) was R-113 (Figure 3).

The graph in Figure 4 shows the percent of each type of refrigerant usage as broken down by capacity range. R-22 is almost exclusively limited to use in units under 100-ton capacity. R-11 is used primarily in units above the 100-ton capacity range.

Of the units surveyed, 92 percent used R-22, but this 92 percent accounted for only 45 percent of the total cooling capacity surveyed. This is due to the fact that 73 percent of the units using R-22 were in the 5- to 25-ton capacity range.

Four percent of the units surveyed used R-11, but this 4 percent represented 37 percent of the total cooling capacity surveyed. Note that all units using R-11 were over 100-ton capacity. Of the units in the 101- to 200-ton capacity range, 28 percent used R-11, 56 percent of the units in the 201- to 500-ton capacity range used R-11, and 100 percent of the units over 500 ton used R-11 (Figures 5 and 6).

Figure 6 shows that, if the chillers using R-11 were replaced with chillers using environmentally friendly refrigerants, only 4 percent (22 chillers) of the chillers surveyed would have to be replaced to remove 41 percent of the refrigerant usage on base. In contrast, 92 percent (498 chillers) of the chillers using R-22 would have to be replaced to remove 40 percent of an unfriendly refrigerant (Figure 7).

Only 2.8 percent of the units used R-12, and these accounted for 12 percent of the total cooling capacity. Less than 1 percent of the units under 5-ton capacity used R-12. No units in the 26- to 100-ton range used R-12, 24 percent of the units in the 101- to 200-ton capacity range used R-12, 38 percent of the units in the 201- to 500-ton capacity range used R-12, and none of the units over 500-ton capacity used R-12. Also, R-12 is an obsolete refrigerant which is being phased out of production by the end of 1995. To replace R-12, which accounts for 12 percent of the cooling capacity surveyed, 3 percent of the units surveyed would have to be replaced. This 12 percent becomes a more relevant concern after comparing the price per pound of R-12 vs. R-11 paid by Fort Hood (Table 3).

Only 1.1 percent of the units used R-113 as a refrigerant, which accounted for 5 percent of the total cooling capacity. The only units that used R-113 were in the 101-to 200-ton and 201- to 500-ton range; 20 percent of the units in the 101- to 200-ton capacity range used R-113, and 6 percent of the units in the 201- to 500-ton capacity range used R-113.

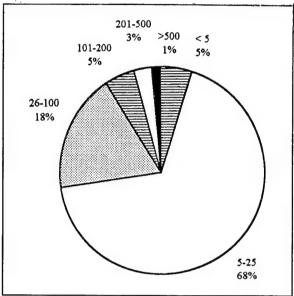


Figure 1. Percentage of units in each capacity range.

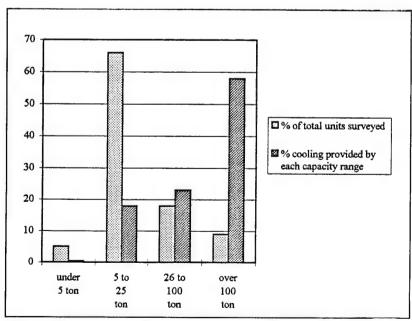


Figure 2. Percentage of units surveyed versus percentage cooling capacity.

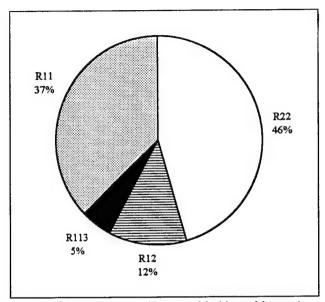


Figure 3. Percent of cooling provided by refrigerant type.

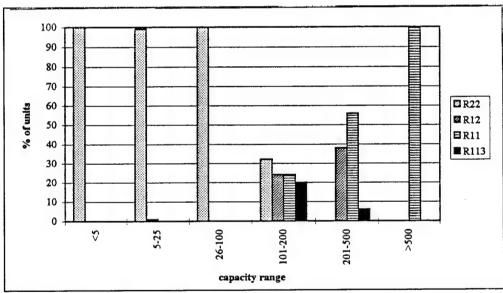


Figure 4. Refrigerant usage by capacity range.

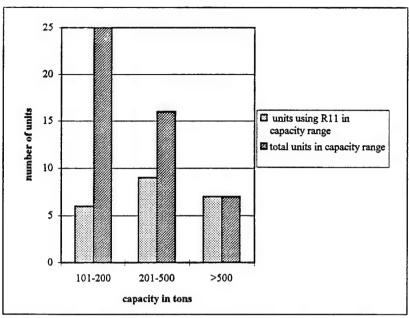


Figure 5. R-11 units versus total units in capacity range.

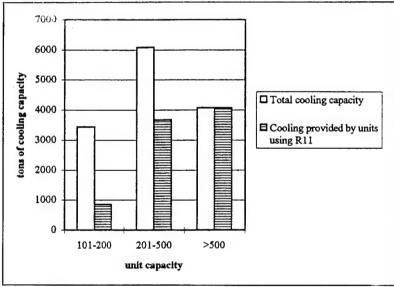


Figure 6. Total cooling capacity versus capacity provided by R-11 units.

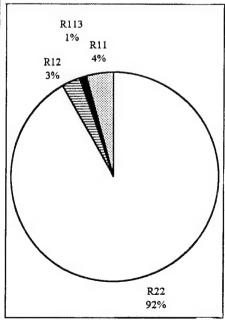


Figure 7. Percent of units by refrigerant type.

9 Conclusions and Recommendations

Conclusions

Objective No. 1: Reduce Energy Cost and Consumption

Review of Table I10 (Appendix I) indicates that economically viable conservation opportunities with significant potential exist at Fort Hood. For ECO-1, where chiller replacement was evaluated, 7 of 29 plants show simple payback periods less than 10 years. These plants, which represent nearly 50 percent of installed capacity, have combined savings of 32 percent in electrical demand, 26 percent in energy consumption, and 30 percent in annual operating costs. Their average simple payback periods are 7.9 years for capital costs related to energy conservation (net cost), and 8.7 years if all costs required to implement ECO-1 are considered (gross cost). The next group of 10 plants, which represent an additional 18 percent of installed capacity, show similar savings of 29 percent demand, 25 percent energy, and 28 percent annual operating costs, respectively, which yield combined payback periods of 13.9 years and 16.1 years, respectively, for net and gross costs. Estimated costs to implement ECO-1 for these 17 plants are \$3,574,000 net and \$4,002,000 gross, less a projected utility rebate of \$178,500.

Replacement of chillers in the remaining 12 plants for energy conservation purposes (3 plants were excluded from consideration) will not be cost effective. Their replacement will largely depend on how the Directorate of Public Works (DPW) plans to cope with CFC refrigerant issues and their expected remaining useful life.

In terms of achieving basewide reductions of 20 percent in both energy cost and consumption, implementation of ECO-1 for the best 17 plants will reduce demand by 21 percent, energy consumption by 18 percent, and cost by 20 percent, from current levels for the 29 plants in this study. Because these savings are based on the assumption that existing chillers are operating in like-new condition, which is known not to be true, actual savings will exceed these predictions.

Implementation of the other primary ECO evaluated in this study, installation of variable speed drives for chillers, will reduce consumption for that group of chillers from 10 to 25 percent. However, costs will be reduced by only 4 to 8 percent because

these devices cannot reduce peak demand. Simple payback periods ranging from 6 to 13 years indicate that variable speed drives for chillers will likely survive life-cycle cost analysis.

Objective No. 2: Reduce Environmental Impact

The single most important environmental concern related to the operation of chiller plants involves the CFC refrigerant issue. Data sufficient to quantify the magnitude of this problem at the subject plants is not currently available. The only records provided were gross consumption of each refrigerant for the entire post. However, two of the refrigerants on the inventory would have limited use beyond central plant chillers, and speculation regarding their consumption rates would not be unfounded. Such analysis reveals the potential for alarming discharge rates of both compounds. For example, annual emissions of R-11 could exceed the legal limit by a factor of over 20. Evidence of significant efforts to reduce refrigerant emissions was not observed.

Implementation of ECO-1 will naturally assist in this regard because annual leakage rates of new chillers (typically well below 1 percent of their charge) will be far less than the machines they replace. Installation of new-technology rupture disks and high-efficiency purge units are recommended for the remaining chillers to conserve refrigerant, especially for R-11 and R-113 chillers, which lose most of their charge during normal purge cycles. For medium and high pressure chillers that operate with R-12 or R-22, improved maintenance procedures (which identify and repair offending machines) are suggested as the primary means of reducing undesirable emissions.

Objective No. 3: Document Analysis Techniques and Methodologies

Efforts to accomplish the third objective were successful in several areas. This report documents a modeling technique for chiller plants that allows rapid evaluation of alternatives with minimal user inputs. Suggested improvements are documented for known shortcomings. Also discussed are the difficulties encountered with the simplified approach used for this project, and recommendations are given that should improve the results of similar future projects.

Recommendations for Implementing ECOs

Appendix N presents the basewide plan for implementing chiller ECOs formulated by USACERL.

Upgrades that improve efficiency and accomplish alternate refrigerant objectives should be implemented in a plan based on results in Tables I10 (Appendix I) and L1 (Appendix L). A preferred plan will be outlined here. As was done for ECO-1, this plan is described by grouping buildings according to nine categories of work. Recommendations for categories one through seven, which include almost all work associated with chiller upgrades, are summarized in Table M1 (Appendix M).

Replace Chillers Immediately

Buildings are assigned to this category if net payback periods for replacement chillers are less than 18 years, and refrigerant conversions or retrofits are not available for chillers in these plants. On verification by life-cycle cost analyses, projects to replace chillers in the following buildings should proceed immediately: 5764, 27004, 41003, 50001, 50004, and 91001. The estimated cost for this category of work is \$943,410 net and \$1,074,327 gross, less a utility rebate of \$33,615.

Perform Eddy Current Tests, Then Retrofit or Replace Chillers Accordingly

Chillers are included in this category if they have the potential for a conversion or retrofit that could cost substantially less than a new chiller. An eddy current test, along with all other tests appropriate for the type of potential upgrade, should be performed for chillers in the following buildings: Group 1, 29005, 39015, 39043, and 87018; Group 2, 121 and 42000; Group 3, 5792, 14020, and 14023; Group 4, 7051, 36006, and 50004 (newest 1 of 3). Groups 1, 2, and 3 contain retrofit candidates organized by refrigerant type and potential payback period. Group 4 includes all conversion candidates in this study. Eddy current testing of all machines is estimated to cost \$17,000. If testing reveals that a machine is not suitable for continued long-term service on a retrofit or conversion, that machine should be replaced. Total costs to replace all chillers in this group, except for the chiller that was already replaced in Building 50004, are estimated to be \$2,526,740 net and \$2,788,233 gross, less a utility rebate of \$144,246. However, if all subject chillers are found to be suitable for retrofit or conversion, capital costs could be reduced by approximately 35 percent. Costs for this scenario are estimated to be \$1,571,485 net and \$1,832,978 gross, less a utility rebate of \$144,246.

Each building in Group 1 contains two large R-11 centrifugal chillers. A retrofit for these candidates could reduce installation costs by nearly 40 to 50 percent compared to new equipment. Buildings 29005 and 39015 may be more likely candidates because capacity reductions appear acceptable, and this may be a factor in equipping Trane chillers with York compressors. This group should be tested first.

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Chillers in Buildings 121 and 42000 of Group 2 are also R-11 retrofit candidates in which capacity reductions appear acceptable, but potential cost savings for retrofit versus replacement fall to the range of 20 to 30 percent.

Buildings in Group 3 contain three of the five R-113 machines in the study. Although predicted capital savings for retrofit compared to replacement are 30 percent, the possibility for successful retrofit installations in these buildings is slim because equal or increased capacity is indicated. In addition, preliminary investigation for suitable compressors should precede testing of these chillers.

The four chillers in Group 4 are conversion candidates that offer savings in capital cost, compared to new equipment, of up to 80 percent. Unfortunately, the 10 to 15 percent loss in capacity that accompanies these refrigerant conversions will require relocation of all four chillers to buildings in which they could meet peak cooling loads. Both chillers in Building 7051 could be relocated to Building 7050; and one chiller from each of Buildings 36006 and 50004 could be relocated to Buildings 21002 and 194, respectively. Also note that capacity reductions will cause corresponding reductions in chiller efficiencies, but simple payback periods ranging from 5 to 13 years for this group appear acceptable.

Convert and Relocate Chillers

The outcome for existing chillers in Buildings 194, 7050, and 21002 should depend on the results of eddy current testing of chillers slated for relocation to these buildings. Potential conversion and relocation candidates are discussed in the preceding paragraph. When candidates are unsuitable for conversion, new chillers should be installed in Buildings 7050 and 21002 and the chiller in Building 194 should remain in service. The cost to convert and relocate four chillers is an estimated \$120,000 net and \$206,214 gross. If three new chillers are installed, estimated costs are \$364,911 net and \$436,455 gross, less a utility rebate of \$8,890.

Refurbish Remaining Chillers for Refrigerant Conservation

Chillers in the preceding categories that are not replaced should be refurbished with new rupture disks and high-efficiency purge units when applicable. Serious "leakers" should receive cost-effective repairs, as should any chillers for which light-duty maintenance would improve operating efficiency. In addition, chiller rooms in this category should be upgraded to conform with current recommendations and regulations. At the minimum, this category includes Buildings 135, 410, 2805, 28000, 31008, 34008, 36009, and 36014. Costs to install rupture disks and purge units are estimated to be \$8,900 for these buildings. Costs for other types of repair work could

not be quantified. Mechanical room upgrades are estimated to cost \$49,558 for five of the seven buildings in which such work is indicated. Separation of boilers and chillers in Buildings 31008 and 34008 cannot be accomplished without relocating the one chiller in each plant to a new extension of the mechanical room. The cost to construct the additions is an estimated \$23,752 each. Costs to relocate chillers, piping, etc. are not included.

Compare Replacement, Retrofit, Conversion, and Maintenance Options

Building 36000, the main hospital and final plant to be discussed, is in a separate category to illustrate the economics of alternatives for multiple-chiller plants. At the minimum, one of three existing chillers, which was out of service during all site visits, appears to require replacement. The replacement chiller could be the same size, or it could be upsized to allow refrigerant conversion of the two remaining R-11 chillers, which are relatively new and excellent candidates for this type of upgrade. The study assumed a 557-ton replacement chiller for this purpose. The alternatives of installing one new machine or installing one new machine and converting the other two was compared to replacing all three chillers. Net simple payback periods are 9.9, 43.3, and 21.5 years, respectively. Costs are shown on Table M1 (Appendix M). For this plant, it is recommended that only one new machine be installed; the other two machines should receive attention to eliminate leaks that are documented as excess purge cycles on their control panels. Being relatively new does not guarantee that these chillers are in good condition, but they do seem to be. Payback periods greater than 20 years to replace them should be sufficient incentive to provide excellent maintenance to these machines.

Manage Refrigerant Inventories

Other potential benefits of scenarios described here are not immediately obvious. For example, up to six R-12 chillers could be replaced in the short term as described here. Disposition of these chillers would yield 4900 lb of refrigerant, which would create a stockpile for the remaining five R-12 chillers that have a combined charge of 2300 lb. If the remaining chillers were maintained so their annual leakage rates did not exceed the legal limit of 15 percent of system charge, the stockpile would last for at least 14 years. Also, at actual prices paid during 1993 for R-12, that stockpile represents over \$36,000. A similar analysis for R-11 would reveal an even larger stockpile. Management of these inventories will become increasingly important as CFC refrigerants become scarce and prices rise accordingly.

Install Variable Speed Drives for Suitable Chillers

Energy savings predicted in this study should be confirmed with factory simulations for 13 buildings in which the lead chiller was modeled with a variable speed drive. The subject buildings listed in Tables J3 (Appendix J), and repeated in Table M1 (Appendix M), include 11 new lead chillers and 2 existing screw chillers. Installation of 13 drives is estimated to cost \$605,536.

Replace Chilled and Condenser Water Pump Motors

Bulk purchase and installation of premium-efficiency motors will likely increase the cost effectiveness of this measure. For all buildings in which existing pump motors would not be affected by work related to chiller replacement, these motors should be replaced. An overall listing of pump motors is available from Tables D4 and D5 (Appendix D). This initial listing should be edited to exclude all existing motors that would be affected by chiller replacement. Discussions earlier in this chapter and in Chapter 5 for ECO-1 need to be consulted during this editing process. In addition, the horsepower rating of replacement motors should be determined with due respect to the large number of pumping circuits in which flow deviates excessively from specified values. The horsepower rating of the replacement motors should be determined after required corrections have been made to the piping system. Flow rates then should be set in accordance to manufacturers specifications. The estimated cost for this upgrade should not exceed \$142,000.

Implement Demand Limiting

Chiller replacement recommended under ECO-1 would affect 70 percent of the demand created by all chillers in this study. All new and upgraded chillers should be equipped to incorporate demand limiting as installation of the basewide energy monitoring system progresses. The additional cost to include this feature with new chillers is negligible compared to potential savings.

Recommendations for Revising Study Methodologies

Theory

This report presents the assessment of potential for gross energy savings at chiller plants serving Fort Hood. This study documents that potential does exist. Also, there is potential for learning from this experience.

Two of the most time-consuming efforts involved in this type of work are establishing a design cooling load and determining the actual operating efficiency of existing equipment. Answers to the question, "To what extent do variations in these two values affect the results of life-cycle cost analyses?", should provide insight for future work. A sensitivity analysis is recommended for this purpose.

The work would involve preparation of at least four sets of energy simulations, cost estimates, and possibly life-cycle cost analyses for either the buildings in this study or a generic group targeted for other objectives, i.e., different types of buildings or incremental sizes of plants. The simulations would model design cooling loads projected from field measurements, and design cooling loads equal to rated capacities of existing equipment. Each of these conditions would be modeled with like-new chiller efficiencies and with reduced efficiencies to account for aging equipment and/or poor maintenance practices. With another data set already available from this report, results should be analyzed for correlations. This work is believed necessary because results in this study are based, in part, on data available from a previous study. Such will not be the case for Army-wide energy conservation investigations.

Application

Some portion of field investigation time was used ineffectively to obtain measurements that were ultimately determined to be of little value. Therefore, work during initial visits should be limited to obtaining nameplate information and an overall understanding of peculiarities at the site. Potential locations for measurement instrumentation, including flow meters, should be documented as should other deficiencies that require corrective work to make follow-up visits as productive as possible. Initial site visits should be scheduled to allow time for corrective work to be completed before the next cooling season. It is not essential that equipment be operating during these visits.

The next step would necessarily involve contacting manufacturers for design specifications. This is a time-consuming endeavor. One must provide written requests to the proper departments of each equipment manufacturer. Manufacturering companies generally are organized so different offices support different product lines. Hence, numerous phone call facsimile transmissions (faxes) are required to request information. Even more calls/faxes are required to ensure delivery of information. (Generally manufacturers recognize that responding to requests for information from consultants/researchers undertaking energy efficiency studies rarely results in equipment sales.)

Availability of data from manufacturers on the specific chiller in question will influence work from this point. If rated capacities and like-new efficiencies are sufficient to provide the intended results, analysis work can continue most efficiently. For this work, calculated loads available from a previous study were used with original equipment efficiencies. If more detailed results are required, additional resources must be allocated for this work. These resources must be consistent with the level of effort required to develop better information and the degree of improvement it provides.

Two notes about field measurements will conclude this report. Snapshot views obtained from one-time measurements must be used with caution unless details that qualify these measurements also are obtained and documented. In addition to recording dates, times, outside air temperatures, and solar conditions, information that describes the status of buildings served by the plants is necessary. The preferred method for obtaining more reliable information involves continuous monitoring of key variables for periods of at least 1 week. For sites not equipped with this capability, such instrumentation could be installed permanently and used to monitor the performance of subsequent ECOs or, for reduced capital cost, a fair portion of the instrumentation could be rotated to other buildings.

References

Cited

- Basewide Energy Conservation and System Plan, consultant's engineering report for Fort Hood DPW (Black & Veatch, 1979).
- Energy Engineering Analysis Program (EEAP), Boiler/Chiller Plant Study, Fort Hood, Texas (Romine, Romine and Burgess, Inc., August, 1991).
- 3. American Society of Heating, Refrigerating and Air Conditioning Engineers, Handbook of Heating, Ventilating, and Air-Conditioning Systems and Equipment (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. [ASHRAE], 1992).
- Commercial/Industrial Demand-Side Management Programs (Texas Utilities Electric Company, 1993).
- Means Mechanical Cost Data, 1993 (R.S. Means Company, Inc., 1993).
- Means Mechanical Cost Data, 1994 (R.S. Means Company, Inc., 1994).
- 7. Means Square Foot Costs, 1993 (R.S. Means Company, Inc., 1993).
- Air-Conditioning and Refrigeration Institute, Standard 550-77 (Air-Conditioning and Refrigeration Institute [ARI], Arlington, VA, 1992).
- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15-1992 (ASHRAE, 1992).
- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Handbook of Fundamentals (ASHRAE, 1993).
- 11. Refrigerant Recycling and the Prohibition on Venting, Summary of Final Rule (U.S. Environ mental Protection Agency, April 1993).

Uncited

Refrigeration System Equipment Room Design, Applications Engineering Manual, REF-AM-3 (The Trane Company, August 1992).

Technical Manual (TM) 5-785, Facility Design and Planning—Engineering Weather Data (Head-quarters, Department of the Army [HQDA], Washington, DC, 1 July 1978), pp 3-374 and 3-375.

York Products and Services for CFC Management, 2nd Edition, Form 50.60-MG2 (York International Corp., June 1992).

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Appendix A: CFC Refrigerant Issues

Introduction

Two atmospheric scientists from the University of California at Irvine developed a theory in 1974 that chloroflourocarbons (CFCs) and hydrochloroflourocarbons (HCFCs) were depleting the earth's ozone layer. Their theory maintains that stable CFC or HCFC compounds migrate into the upper atmosphere where they are bombarded with solar radiation. That exposure to radiation leads to the breakdown of the CFC or HCFC molecule, which releases chlorine ions. The free chlorine ions react with ozone to create chlorine monoxide. To prevent this last reaction from destroying the ozone layer, the United Nations (UN) became involved to eliminate the use of CFCs and HCFCs. Many of the traditional refrigerants used in the airconditioning industry are affected by this issue. CFCs include R-11, R-12, and R-113. HCFCs include R-22.

Montreal Protocol and Clean Air Act

The ozone depletion theory grew into a raging environmental issue that was addressed by the UN world community of 11 industrial nations. The results of the first UN meeting (known as the Montreal Protocol) and two subsequent meetings are agreements to phase out production of all CFC and HCFC compounds. In 1992 the Bush administration accelerated the deadline for eliminating CFC production imposed by the Montreal Protocol. This new policy is called the Clean Air Act. Updated deadlines established by the Clean Air Act include:

- January 1, 1995—ban production of all CFC compounds
- January 1, 2020—ban production of all HCFC compounds.

Availability of CFCs

Deadlines imposed by the Clean Air Act do not prevent manufacturers of CFC compounds from stopping production before the deadline. DuPont, the world's largest producer of CFCs, has announced their decision to cease production of this

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material by sometime early in 1994*. Reduced availability of CFCs from previous cutbacks already has affected costs, and this trend will worsen. Prices for R-11, which had been relatively stable from 1990 to 1991, increased between 50 and 100 percent by 1993. Various sources project future increases upward from 100 percent to the end of the decade, but variables such as excise tax and the effect of conversions/retrofits make these predictions difficult. At any rate, maintenance practices should improve and focus on reducing the loss of CFCs for legal, environmental, and economic reasons.

Alternative Refrigerants

Newly developed refrigerants R-123 and R-134a will replace R-11 and R-12, respectively. These new compounds will join with R-22 to provide at least three refrigerant choices for the next 25 years. R-123 is an HCFC-based refrigerant designed for low pressure operation, and R-134a is a hydroflourocarbon-based (HFC) refrigerant designed for medium pressure machines. Of the three choices, note that both R-123 and R-22 are scheduled to be eliminated by the year 2020. R-134a does not contribute to problems with the ozone layer because it does not contain chlorine, so R-134a has an unlimited future in this respect. However, this refrigerant may face potential regulations to control global warming. An acceptable substitute for R-113 has not been developed. Therefore, it is critical that machines using these refrigerants be well maintained because, with no alternative refrigerant available, these machines will be inoperable when the last of the R-113 is gone. Equipment designed to operate with the properties of this refrigerant will need a major upgrade to remain in service, or this equipment will have to be replaced.

The environmental benefits of alternate refrigerants are provided at the expense of some efficiency compared to traditional refrigerants. Theoretical performance at 40 $^{\circ}$ F evaporating and 100 $^{\circ}$ F condensing is listed in Table A1 10 . These values indicate why R-11 has been the refrigerant of choice up to this time.

USEPA Regulations

The USEPA established refrigerant recycling requirements under Section 608 of the Clean Air Act Amendments of 1990. Highlights of Section 608, including final regulations signed by the Administrator on April 23, 1993, and highlights of the

DuPont issued a statement in December 1994 (#231697D), which stated in part, "Phaseout of production and consumption of CFCs, methyl chloroform and tetrachloride by January 1, 1996."

Table A1. Theoretical performance of refrigerants.

Refrigerant	Theoretical Performance (hp/ton)		
R-11	0.636		
R-113	0.710		
R-123	0.663		
R-12	0.689		
R-134a	0.712		
R-22	0.696		

prohibition on venting CFCs that became effective on July 1, 1992, are outlined here¹¹. The majority of requirements contained in Section 608 became effective in mid-1993.

- Air-conditioning and refrigeration equipment service and disposal practices shall maximize recycling of ozone-depleting compounds (CFCs and HCFCs).
- Contractors, service technicians, reclaimers, and recovery and recycling equipment shall all be certified.
- Refrigerants shall be sold only to and by certified technicians.
- Substantial leaks in air-conditioning and refrigeration equipment with a charge greater than 50 lb shall be repaired, or a retrofit or retirement plan shall be submitted to the USEPA within 30 days of the violation. Annual leakage rates of 35 percent of system charge for industrial process and commercial refrigeration equipment and 15 percent of system charge for comfort cooling equipment define the maximum permissible rates of discharge.

Owners of equipment with a charge greater than 50 lb must maintain a record of all refrigerant added to such equipment during service procedures. These records shall be presented to the USEPA on request.

Knowingly venting ozone-depleting refrigerant compounds into the atmosphere while maintaining, repairing, or disposing of air-conditioning or refrigeration equipment is unlawful and subject to a fine of \$25,000 per day per violation. Circumstances of certain discharges may be evaluated before enforcement is pursued. The USEPA places a high priority on responding to tips of such acts.

Safety Code for Mechanical Refrigeration

A safety code for mechanical refrigeration (ANSI/ASHRAE 15-1992)⁹ was approved by the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) on July 2, 1992, and by the American National Standards Institute (ANSI) on October 26, 1992. This code sets forth recommended guidelines to promote the safety of persons and property located on or near premises where refrigeration facilities are located. These guidelines become legally binding upon adoption by authorities having jurisdiction, but they should be followed in any event as good engineering practice. Highlights of this standard as they apply to mechanical rooms at Fort Hood are outlined here⁹. However, the standard shall be consulted for a complete understanding of the detailed requirements that are impractical to include in this report. Also, requirements of several other codes and standards, such as the Uniform Building Code and National Fire Codes, normally apply to refrigeration systems and associated structures.

Characteristics of chiller plants in this study, as defined by ANSI/ASHRAE 15-1992⁹, are listed in Table A2. Requirements for all refrigerants of concern are generally the same, except for those based on quantity, and those that require different monitoring for R-123 because of its higher toxicity.

Table A2. ANSI/ASHRAE 15-19929 Classifications.

Characteristic	Classification
Occupancy	Commercial (some public assembly also)
Refrigerant Group	A1 for R-11, 113, 12, 134a and 22 (No Flame Propagation, Lower Toxicity)
	B1 for R-123 (No Flame Propagation, Higher Toxicity)
Refrigerant System	Indirect closed
System Probability	High for mechanical rooms containing air handling units and ductwork
	Low for most all others

General Construction

Mechanical rooms that contain refrigeration equipment shall be separated from adjacent occupied areas by wall, floor, and ceiling assemblies that meet requirements for 1-hour, fire-resistive construction. Access directly outdoors shall be provided. All

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penetrations for ductwork, piping, conduit, etc. shall be sealed tight; no other types of openings are permitted.

At least one self-contained breathing apparatus shall be available outside the entrance to the room. A back-up apparatus is strongly recommended.

Combustion Air

If a boiler and refrigeration machine are located in the same enclosed space, combustion air shall be drawn into the boiler directly from outdoors. The intent is to prevent stray refrigerant from entering the boiler because resultant products of combustion are dangerous to humans and corrosive to equipment. Practical solutions for most instances involve isolating the refrigeration machine within a dedicated enclosure.

No other equipment with an open flame that can draw combustion air from within the room is permitted.

Ventilation

Rooms that contain refrigeration equipment shall be equipped with a mechanical ventilation system (including one or more power-driven exhaust fans) designed to provide two modes of operation, normal and purge.

The minimum flow rate for purge ventilation shall be calculated with the following equation:

$$Q = 100 * G^{0.5}$$
 [Eq A1]

where:

Q = flow rate in cubic feet per minute

G = mass of refrigerant in pounds contained in the largest system, any part of which is located in the equipment room.

Minimum flow rates for normal ventilation shall satisfy two criteria: provide the larger of 0.5 cfm per square foot of floor area or 20 cfm per occupant; and limit, when desired by the occupant, the maximum temperature rise due to all heat-producing equipment to $18\ ^{\circ}F$.

Normal and purge ventilation modes may be provided by the same equipment. Capacity reduction methods such as multiple fans or multispeed motors are acceptable.

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Make-up and discharge openings shall be located to prevent recirculation or cause potentially dangerous conditions.

If the enclosure that contains refrigeration equipment is located at least 20 ft from the nearest opening into another building, requirements for both ventilation modes may be satisfied by natural ventilation. The minimum free area of opening(s) in the enclosure shall be calculated with the following equation:

$$A = G^{0.5}$$
 [Eq A2]

where:

A = minimum free area in square feet

G = mass of refrigerant in pounds contained in the largest system, any part of which is located in the equipment room.

Opening(s) shall be located with due respect to the difference in density between air and the subject refrigerant.

Controls

Remote pilot control of mechanical equipment in the mechanical room shall be provided immediately outside the mechanical room for emergency shutdown purposes. Ventilation fan control shall be provided at the same location and shall be installed on a separate circuit. If manual control is provided for the normal ventilation mode, a sign shall warn that operation is required during all occupied periods.

Monitoring and Alarms

Monitoring and alarm requirements vary depending on the refrigerant group classification. The procedure that determines this classification was established by The American Society of Mechanical Engineers (ASME). The degree of flammability is signified by an increasing numerical value (1, 2, or 3); the degree of toxicity is signified by a letter (A or B).

An oxygen sensor, set to alarm at levels less than 19.5 percent by volume, shall be installed for Group A1 refrigerants. A refrigerant vapor sensor, set to alarm at values no greater than the corresponding threshold limit value (TLV), shall be installed for refrigerants in all other groups (except ammonia). This type of sensor is an acceptable substitute for the oxygen sensor required for Group A1 and is recommended. The vapor-type sensor is capable of detecting a refrigerant leak much

sooner than an oxygen sensor, which could minimize the loss of the refrigerant charge.

When the measured condition reaches a predetermined setpoint, the purge mode ventilation system shall be energized and an alarm shall be initiated.

Appendix B: Organizations Contacted

Aurora Pump (pump manufacturer) 800 Airport Road North Aurora, IL 60542 708-859-7000

Beckwith & Kuffel, Inc.
5930 First Avenue South
Seattle, WA 98108-3248
206-767-6700
manufacturer's representative for Goulds Pumps, Inc. (pump manufacturer)

G.J. Campbell & Associates
11613 Rainer Avenue South
Seattle, WA 98178
206-772-111
manufacturer's representative for Baltimore Aircoil Company (cooling tower manufacturer)

Carrier Corp. Building Systems & Services
655 South Orcas, #100
Seattle, WA 98108
206-439-0097
manufacturer's representative for Carrier Corp. (chiller manufacturer)

Griffin Commercial Parts, Inc.
6031 Airport Way South
Seattle, WA 98108
206-763-8921
manufacturer's representative for Dunham-Bush (chiller manufacturer)

Larry Harrington Company, Inc.
P.O. Box 4326
Portland, OR 97208
503-228-4324
manufacturer's representative for ITT Bell & Gossett (pump manufacturer)

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Havens Cooling Towers, Inc. (cooling tower manufacturer)
P.O. Box 213
Sunrise Beach, MO 65079
314-374-4546

MagneTek (motor manufacturer) 333 Route 46 Fairfield, NJ 07004 800-622-2924

Marathon Electric Manufacturing Corp. (motor manufacturer) P.O. Box 8003 Wausau, WI 54402 715-675-3311

Natkin Service Company (building systems service company) 12815 N.E. 124th Street, Suite L Kirkland, WA 98034 206-821-8700

Norby Company
3805 108th N.E.
Bellevue, WA 98004
206-624-2411
manufacturer's representative for Snyder General Corp. (chiller manufacturer)

Olympic Engineered Sales, Inc.
P.O. Box 549
Bellevue, WA 98009
206-454-0701
manufacturer's representative for The Marley Cooling Tower Company

PACO Pumps, Inc. (local PACO pump representative) 3215 South 116th Street, #109 Seattle, WA 98168 206-433-2600 Pumptech, Inc.
13251 Northup Way
Bellevue, WA 98005-2009
206-644-8501
manufacturer's representative for Peerless Pump Company

A.D. Reid Northwest, Inc.
P.O. Box 24203
Seattle, WA 98124
206-624-2183
manufacturer's representative for EVAPCO, Inc. (cooling tower manufacturer)

Roberts Trane Company
2021 152nd Avenue, NE
Redmond, WA 98052
206-643-4310
manufacturer's representative for The Trane Company (chiller manufacturer)

Scot Division of Ardox Corp. (pump manufacturer) 6437 Pioneer Road Cedarburg, WI 53012 414-377-7000

Taco, Inc. (pump manufacturer) 1160 Cranston Street Cranston, RI 02920 401-942-8000

Texas Utilities Electric Company (electric utility company) P.O. Box 100001 Dallas, TX 75310-0001 214-791-2888

Tri-Thermal, Inc. (cooling tower representative) P.O. Box 52752 Tulsa, OK 74152 918-834-3600 Triangle Pumps, Inc.
P.O. Box 950
Clackamas, OR 97015
206-251-9666
manufacturer's representative for the following motor and pump manufacturers:
Aermotor, Weinman, Midland, Mueller

U.S. Electrical Motors (motor manufacturer) 58 Robinson Boulevard, Suite C Orange, CT 06477 800-243-2700

Washington Air Reps, Inc.
3290 146th Place SE, Building A
Bellevue, WA 98007
206-562-1150
manufacturer's representative for York International Corp. (chiller manufacturer)

York International Corp. (Seattle office of chiller manufacturer) 221 S.W. 41st Street Renton, WA 98055 206-251-9145 Appendix C: Listing of Plants and Buildings Served

APPENDIX C

Table C-1. Chiller Plants and Buildings Served

TRIP NOTES	PLANT NO.	PLANT BLDG NO	SERVED BLDG NO	BUILDING NAME
	1	121		GENERAL PURPOSE ADMIN
10	2	135		POST EXCHANGE OFFICE
	3	194		NON-COM DINING
	4 5	334 DX		THEATRE
	6	410 2805		DIVISION HQ
	7	5764		RECREATION CENTER OFFICER DINING
	8	5792		BOQ
8	_	0.02	5786	BOQ
			5788	BOQ
			5790	BOQ
	9	7050		TRAINING FLIGHT SIMULATOR
	10	7051		TRAINING FLIGHT SIMULATOR
1	11	9418		EM BARRACKS W/ ADMIN & SUPP
1			9210	EM BARRACKS W/ ADMIN, SUPP & DINING
			9211	EM BARRACKS W/ ADMIN, SUPP & DINING
			9213	EM BARRACKS W/ ADMIN, SUPP & DINING
			9414	EM BARRACKS W/ ADMIN, SUPP & DINING
			9419	EM BARRACKS W/ ADMIN & SUPP
			9420	EM BARRACKS W/ ADMIN & SUPP
			9421	EM BARRACKS W/ ADMIN & SUPP
			9422	EM BARRACKS W/ ADMIN & SUPP
			9423	EM BARRACKS W/ ADMIN & SUPP
			9424	EM BARRACKS W/ ADMIN & SUPP
6	12	10006	9425	EM BARRACKS W/ ADMIN & SUPP
•		10000	10001	EM BARRACKS W/ ADMIN & SUPP EM BARRACKS W/ ADMIN & SUPP
			10001	EM BARRACKS W/ ADMIN & SUPP
			10002	EM BARRACKS W/ ADMIN & SUPP
			10004	EM BARRACKS W/ ADMIN & SUPP
			10005	EM BARRACKS W/ ADMIN & SUPP
			10007	EM BARRACKS W/ ADMIN & SUPP
			10008	EM BARRACKS W/ ADMIN & SUPP
			10009	EM BARRACKS W/ ADMIN & SUPP
			10010	EM BARRACKS W/ ADMIN & SUPP
			10011	EM BARRACKS W/ ADMIN & SUPP
			10016	EM BARRACKS W/ ADMIN & SUPP
			10018	EM BARRACKS W/ ADMIN & SUPP
			10020	EM BARRACKS W/ ADMIN & SUPP
			10021 10022	EM BARRACKS W/ ADMIN & SUPP
	13	14020	10022	EM BARRACKS W/ ADMIN & SUPP EM BARRACKS W/ ADMIN, SUPP & DINING
	.0	14020	14019	EM BARRACKS W/ ADMIN, SUPP & DINING
	14	14023	14010	EM BARRACKS W/ ADMIN, SUPP & DINING
			14022	EM BARRACKS W/ ADMIN, SUPP & DINING
	15	21002		EM DINING
			21001	GENERAL PURPOSE ADMIN
			21003	EM BARRACKS W/ ADMIN & SUPP
_	16	27004		EM DINING
2			27002	EM BARRACKS W/ ADMIN & SUPP
	47	*****	27006	EM BARRACKS W/ ADMIN & SUPP
	17	28000		DIVISION HQ
	18	29005	29004	CENTRAL ENERGY PLANT
			29004	ADMIN & SUPP EM DINING
3			29007	ADMIN & SUPP
-			29008	EM BARRACKS
			29009	EM BARRACKS
			29010	EM BARRACKS
			29011	ADMIN & SUPP
			29013	GENERAL PURPOSE ADMIN
			29014	DIVISION HQ
			29015	GENERAL PURPOSE ADMIN
			29016	ADMIN & SUPP
			29019	EM BARRACKS
			29020	EM BARRACKS
			29021	EM BARRACKS
7	10	21000	29022	EM BARRACKS
7	19	31008	04007	EM DINING
			31007	EM BARRACKS W/ ADMIN & SUPP
			31009 31010	EM BARRACKS W/ ADMIN & SUPP GENERAL PURPOSE ADMIN
	20	34008	31010	EM DINING
			34006	EM BARRACKS W/ ADMIN & SUPP

APPENDIX C

Table C-1. Chiller Plants and Buildings Served

TRIP NOTES	PLANT NO.	PLANT BLDG NO	SERVED BLDG NO	BUILDING NAME
5	21	36000		MAIN HOSPITAL
	22	36006		BOQ
	23	36009	00007	EM DINING W/ ADMIN
			36007 36008	EM BARRACKS EM BARRACKS
-	24	36014	36008	DENTAL CLINIC
9	24 25	39015		CENTRAL ENERGY PLANT
	25	35013	39001	BATTALION ADMIN
			39002	BATTALION ADMIN
			39004	EM BARRACKS
			39005	EM BARRACKS
			39006	EM BARRACKS
			39007	EM BARRACKS
4			39008	FITNESS CENTER
			39009	DIVISION HQ UNIT CHAPEL
			39010 39011	TROOP MEDICAL CLINIC
			39012	EM BARRACKS
			39013	EM BARRACKS
			39014	POST EXCHANGE OFFICE
			39016	EM DINING
			39017	EM BARRACKS
			39020	ADMIN & SUPP
			39021	ADMIN & SUPP
			39022	ADMIN & SUPP
	26	39043	00000	CENTRAL ENERGY PLANT GENERAL PURPOSE ADMIN
			39030	EM BARRACKS
			39031 39032	EM BARRACKS
			39034	EM BARRACKS
			39035	EM BARRACKS
			39036	EM BARRACKS
			39037	EM BARRACKS
			39038	EM BARRACKS
			39039	EM BARRACKS
			39040	EM BARRACKS
			39041	EM DINING
			39042	ADMIN & SUPP
			39044	ADMIN & SUPP
			39045	GENERAL PURPOSE ADMIN ADMIN & SUPP
			39050 39051	EM BARRACKS
			39052	EM BARRACKS
			39053	EM BARRACKS
			39054	ADMIN & SUPP
	27	41003	-	EM DINING
			41002	EM BARRACKS W/ ADMIN
	28	42000		NON-COM DINING
	29	50001		COMMISSARY
	30	50004		POST EXCHANGE RETAIL STORE
	31	87018		CENTRAL ENERGY PLANT
			87003	GENERAL PURPOSE ADMIN
			87004	ADMIN & SUPP
			87005 87006	DIVISION HQ TROOP MEDICAL CLINIC
			87007	EM BARRACKS
			87008	POST EXCHANGE OFFICE
			87009	BATTALION ADMIN
			87010	FITNESS CENTER
			87011	BATTALION ADMIN
			87012	EM BARRACKS
			87013	EM BARRACKS
			87014	ADMIN & SUPP
			87015	EM BARRACKS
			87016	ADMIN & SUPP
			07047	EM DINING
			87017	
			87019	ADMIN & SUPP
			87019 87020	ADMIN & SUPP EM BARRACKS
			87019 87020 87021	ADMIN & SUPP EM BARRACKS EM BARRACKS
	32	91001	87019 87020	ADMIN & SUPP EM BARRACKS

APPENDIX C

Table C-1. Chiller Plants and Buildings Served

TRIP NOTES

1 PLANT 9418 WAS PARTIALLY DISMANTLED DURING TRIP 1 BECAUSE REPLACEMENT PLANT WAS SCHEDULED TO COME ON-LINE. HOWEVER, CONSTRUCTION OF REPLACEMENT PLANT WAS DELAYED, SO EXISTING PLANT IS BEING REBUILT.

PLANT 9418 AND ASSOCIATED BUILDING 9210 WERE REVISITED BRIEFLY DURING TRIP 2, BUT SINCE THE PLANT IS BEING DEMOLISHED AND DORMITORY IS BEING REFURBISHED, NO DATA WAS COLLECTED.

- 2 BUILDING 27006 WAS INSPECTED IN LIEU OF BUILDING 27002.
- 3 BUILDING 29007 WAS NOT INSPECTED BECAUSE MAINTENANCE PERSONNEL REPORTED IT SIMILAR TO BUILDING 29004.
- 4 BUILDING 39008 IS NOT SERVED WITH CHILLED WATER.
- 5 INSPECTION OF PLANT 36000 WAS APPROXIMATELY 75% COMPLETE AFTER TRIP 1.

PLANT 36000 WAS REVISITED BRIEFLY DURING TRIP 2, BUT SINCE THIRD CHILLER WAS OUT OF SERVICE AND SCHEDULED TO BE REPLACED, NO ADDITIONAL DATA WAS COLLECTED DURING THIS VISIT

6 PLANT 10006 IS REPLACEMENT PLANT THAT IS NOT YET ON-LINE. INSPECTION DURING TRIP 1 CONSISTED OF BRIEF WALK-THRU TO OBSERVE A STATE-OF-THE-ART INSTALLATION FOR THE POST. FURTHER INSPECTION OF THIS PLANT FOR ENERGY CONSERVATION PURPOSES IS NOT WARRANTED.

PLANT 10006 WAS REVISITED BRIEFLY DURING TRIP 2 TO OBTAIN PHOTOGRAPHS ONLY. PLANT SEEMED TO BE ON-LINE FOR TESTING.

- 7 PLANT 31008 WAS OUT SERVICE DURING TRIP 1 BECAUSE COOLING TOWER WAS RECENTLY DAMAGED BY LIGHTNING. THEREFORE, INSPECTION COULD NOT BE PERFORMED AHEAD OF SCHEDULE.
- 8 BUILDING 5790 WAS INSPECTED IN LIEU OF BUILDING 5786.
- 9 PLANT 36014 WAS FOUND TO CONTAIN TWO CHILLERS, ONE OF WHICH WAS INTENDED TO OPERATE WITH SOLAR ENERGY EQUIPMENT. THIS CHILLER IS NOT IN SERVICE.
- 10 PLANT 135 WAS FOUND TO CONTAIN TWO CHILLERS.
- 11 PLANT 91002 WAS RECENTLY UPGRADED WITH ALL NEW EQUIPMENT EXCEPT FOR THE CHILLER, WHICH WAS REPORTED TO REQUIRE EXCESSIVE MAINTENANCE TO REMAIN OPERATIONAL. UPGRADE APPEARED NEARLY COMPLETE. NO DATA WAS COLLECTED.
- 12 PLANT 5764 WAS FOUND TO CONTAIN TWO CHILLERS. THE SECOND, AIR-COOLED, CHILLER WAS DISCOVERED AFTER ALL TRIPS WERE COMPLETED, SO NO DATA WAS COLLECTED.

Appendix D: Chiller, Cooling Tower, Pump

Nameplate, and Field

Measurement Data

APPENDIX D

Table D-1. Chiller Nameplate and Field Measured Data

PLANT NO BLDG NO	8 4 8 1-	MEAS OA DB	MEAS OA WB	TRIP	PLANT	MFG	MODEL	SEHIAL	주 주 주	OPER SCHED	LOAD	ABIP CAP	СОМР	HEF TYPE	CHRG
		u.	Ŀ		TONS					HRWR	TONS	TONS			LBS
12		68	11		200.0	CAPRIER	19DG5333CC	76-25-25213	2/2	4380	138		CENT, HERM	Ξ	400
2 135	1/S-F	85	74	9	128.4	TRANE	COMP MOD = 2-A518	N2C75S6882		4380	25		RECIP-1	12	300
135		85	74		•	WSTNGHS	PKB150	JG7218		4380	38		RECIP-1	83	
3 194	,	06	75		228.0	WSTNGHS	PE225	CR8600	73	4380	107		CENT, HERM	12	680
5 410	0 1/N-F	89	29		220.0	MCQUAY	PE050JAH10R1A31A2X	SPF0300800	84	4380	119	110	CENT, HERM	12	607
410		89	67			MCQUAY	PE050JAH10R1A31A2X	5PF0301100	84	4380	119	110	CENT, HERM	12	209
6 2805		11	73		149.8	AMER STD	COMP MTR MOD - LCF-1944	450-441	61	4380	116		CENT, HERM	113	9
7 5764	**	80	4.		249.6	CARRIER	19C3D6-Q6-R6	60024904		4380	143		CENT, HERM	113	200
5764	2			12						4380	28	80 7	RECIP-2, PKG ?	22 3	
8 5792		88	26	!	170.0	TRANE	PCV-1J-C2D3	L5B19100	75	4380	176	5	CENT, HERM, 2 STG	113	485
0902 6	1/E-F	69	99		420.0	WSTNGHS	PE063KAP26SC02H02X	GZ9000	18	8760	153	210	CENT, HERM	12	790
7050		69	99			WSTNGHS	PE063KAP26SC02H02X	FZ9041	9	8760	153	210	CENT, HERM	12	790
10 7051	_	76	74		170.0	YORK	YTA2B1B1-CFA	YHRM-200948	85	8760	158	150	CENT, OPEN	Ξ	909
	_	76	74			YORK	YTA2B1B1-CFA	YHRM-200949	82	0	i	150	CENT, OPEN	=	909
13 14020		85	74		140.4	TRANE	CVHA-015C-HA-05CC1H1A-C1SH1A521	L77B21864	11	4380	154	150	CENT, HERM, 2 STG	113	415
14 14023	2	98	74		146.0	TRANE	CVHA-015C-HA-05CC1H1A-C1SH1A521	L77B21865	77	4380	166	150	CENT, HERM, 2 STG	113	415
		80	73		215.0	WSTNGHS	PE225	FP8615	7	4380	240	215	CENT, HERM	12	680
	4	79	72		465.0	WSTNGHS	PE460	JQ8575	72	4380	486	465	CENT, HERM	12	1300
	1/N-F	93	75		220.0	WSTNGHS	PE048JAE13RBA3AA2X	HZ9010	8	4380	119	110	CENT, HERM	12	390
28000	00 2/S-B	93	75			WSTNGHS	PE048JAE13RBA3AA2X	HZ9004	8	4380	119	110	CENT, HERM	12	390
18 29005	15 2/S-L	68	99		948.0	TRANE	PCV-4F-C1D1	L4H18209	74	4380	452	8	CENT, HERM, 2 STG	Ξ	880
29005	1/N-R	89	99			TRANE	PCV-4F-C2D2	L4H18208	*	4380	384	400	CENT, HERM, 2 STG	Ξ	880
	. 80	90	11	7	460.0	YORK	YSEBEAS4-CPA	YKYM773894	6	4380	458	200	SCREW	Ø	1350
20 34008		80	73		460.0	YORK	YSEBEAS4-CPA	YKYM773893	6	4380	482	S S	SCREW	ដ	1350
		74	71	2	1277.0	YORK	YTH3J3E2-CRE	MRP439134	06	8760	362	200	CENT, OPEN	=	1400
36000		74	7			YORK	YTH3J3E2-CRD	NA NA	88	8760	362		CENT, OPEN	=	1400
36000	3/N-F	74	7			YORK	HTH4E2-EACS	KM-169129	8	8760	431	200		= :	1150
22 36006	- 9	80	20		275.0	YORK	YTC3C3C2-CKD	YEYM-226389	88	4380	528	250 7		= :	006
		82	78		95.5	CARRIER	30GA105400AA	M595118		4380	9	105	RECIP-4, PKG	2	360
			i			TRANE	ABSC-01A4WG4B1F1EBD1	L79F03704	62 1	0	Z S	5 5	ABSORP, 1 STG	- E	32,0
24 36014		8	73	6	96.2	THANE	CGHA-1001EA51CH5C4C361BE	L/9G03695	5 i	09/9	8	3 3	RECIPITA, HI REC	3 ;	0.07
25 39015	5 1/S-R		F i		1215.0	THANE	CV-6C-G4-H4	L6GZ1256	9 2	4380	5 5 6 F	3 8	CENT, HERM, 2 STO	= ‡	1250
		2 6	= 7		0	ייייייייייייייייייייייייייייייייייייייי	CV-50-05-01	12700067	1 9	2007	7	9 9	CENT HEBY SETS	: :	1100
26 39043	H-W-H	e e	2 2		0.0211	TOANE	CVHA-055C-HA-13NJ1ATA-ZSAZAS11	L//D0086/	: :	4380	542	513	CENT, HERM 2 STG	= =	1250
		2 8	đ i		2 200	TOTAL	CYTE-081C-DA-13MKIA1A-KISAZA311	C) / D00000	: 7	4380	250	3 8	CENT HEBN	: 2	670
2/ 41003		3 8	: }		527.5	Walkers	PE223	VO 22460E	. 5	4380	180	330	CENT HERM	! =	650
		2 3	2 ;		203.0	מיים ל	05-110	200132-00	2	0000	2 5	200	DECIDA SELE	: 8	102
		8 6	2 ;		23.52	CAPTER	30-H3-160-D-600	F-2/ 1404 E11 057140 0500	7	09/9	5 E	8 5	LILE TOUR	7 =	300
		8 3	4 5		3/3.0		CTA564 4 4 0	EM-057150-0640	5 12	9760	5 5	2 5	CENT HEBM	: =	300
50004	2/E-13	4 4	4 7			A S	HI ASA4-AAB OTA543-ODCTC	NM-053469	. E	8750	5 5	5 5	CENT, DEFN	: =	400
50004		4 6	* 0		0000	A PARIE	0.000	14B17296	3 2	4380	487	3 6	CENT HERM 2 STG	=	880
		8	3 8			TOANG	2007470	1 4B17297	7.4	4380	415	6	CENT HERM 2 STG	Ξ	880
90 04004		6 6	2 6		0 10	CABOICO	30CB125650	WSGSJOS	, K	4380	123	125	BECIP'S PKG	25	290
ı		2	2		5.17	100	2000	1100000	}						

APPENDIX D

Table D-1. Chiller Nameplate and Field Measured Data

PLANT NO BLD	g	EVAP	COND	EXIST	EVAP		EVAP DSGN	EVAP DSGN	EVAP DSGN	EVAP	EVAP	EVAP	EVAP	EVAP	EVAP	COND	COND	COND	DSGN
_	_	CONFIG		88/83	SRT		EWT	LWT	FLOW	CALC	SPEC	FUTURE	PASS	FOUL	WPD	SRT	EWT	LWT	FLOW
					ıL		u_	ı.	GPM	CAP	CAP	CAP		FACT	FT	L.	L	u.	GPM
				1,100	'	;	3	,	080	900	0000	438	•		12.1	104.4	85.0	94.7	8
- 1	121 56	ಕ ಕ	WAI	SAME	"	20.1	20.0	45.0 5.0	330	76.7	73.5	8 6	•		į		85.0	95.0	215
	200	5 7	WAT	1 2			2	?	3	1	54.9 E								
ď	2 20	d 7	WAT	SAME	ď	0.9	52.5	44.0	646	228.8	228.0	107	2	0.00050	8.8	105.0	85.0	95.0	677
יט פ	410 014	PAR	WAT	SAME	, e	39.8	56.0	44.0	220	110.0	110.0	119	ဇာ	0.00050	6.6	101.0	85.0	94.7	330
•	410 PA	PAR	WAT	SAME	6	9.6	56.0	44.0	220	110.0	110.0	119	9	0.00050	6. 6	101.0	85.0	94.7	88
9	2805 3G	<u></u>	WAT	SAME				45.0	358 G	-	149.8	116							1
^				SAME			55.0	45.0	428	178.3	178.0	201							535
	5764 PA		? AIR	N 2			55.0	45.0	172	71.7	71.6	0		0.00050	20.0 M		1 5	1 ;	1 8
80	5792 SC	SGL	WAT	SAME			52.9	44.0	458	169.8	170.0	SPEC	꿆	0.00050	17.0		85.0	4.00	8 8
6	7050 PA	PAR	WAT	SAME		34.7	56.0	46.0	497	207.1	210.0	€:	ο.	0.00050	15.9	108.0	90.0	20.5	2 8
	7050 PA	PAR	WAT	SAME	×	34.7	56.0	46.0	497	207.1	210.0	ε	81	0.00050	15.9	108.0	95.0	20.00	200
9	7051 SE	SERVACT	WAT	SAME	×		54.0	44.0	408	170.0	170.0	Ξ:	N (0.00050	6./1		85.0	0.00	2 2
		SER/RED	WAT	SAME	×		54.0	44.0	408	170.0	170.0	Ξ	N	0.00050	8.71		95.0	90.0	200
13	14020 SC	SGL	WAT	SAME			55.4	44.0	296	140.6	140.4	154	2 H	0.00050	14.0		4.0	95.0	124
14	14023 SC	SGL	WAT	SAME			55.6	44.0	305	146.0	146.0	166	2LH	0.00050	14.0	, , , ,	4.00	90.0	000
5	21002 SG	SGL	WAT	SAME	6)	35.1	54.0	43.0	474	217.3	215.0	240	21	0.00050	9.0	104.1	95.0	7.40	200
16	27004 SC	SGL	WAT	SAME		33.2	53.4	43.0	1070	463.7	465.0	SPEC	~ •	0.00050	0 0	0.00	0.00	9.00	330
17	28000 PA	PAR	WAT	SAME	×	39.0	26.0	44.0	220	110.0	110.0	119	m (0.00050	13.5	0.40	0.0	0.40	200
	28000 PA	PAR	WAT	SAME		39.0	26.0	44.0	220	110.0	110.0	119	e .	0.00050	0.00	104.0	0.00	n c	5 55
18	29005 SE	SER/SGL	WAT	SAME			28.0	4.6	1422	509.6	512.0	9	- •	0.0000	0.0		9 0	95.0	127
	29005 SE	SER/SGL	WAT	SAME			49.4	42.0	1422	438.5	436.0	(9)	- «	0.00050	0 0		85.0	93.0	1380
4	31008 SC	SGL	WAT	H :			58.0	42.0	069	460.0	460.0	מבונים מ	9 (0.00023	2000		85.0	94.4	1380
8	34008 SC	SGL	WAT	E I			28.0	42.0	969	460.0	460.0	SPEC SPEC	,	0.00028	16.2		85.0	94.4	200
23	36000 P	PAR	WAT	F :			58.4	62.0	28/	- F04 - F04	0.004	S 6	9 6	0.00025	16.2		85.0	94.4	1200
	36000 P	PAR	WAT	SAME			20.00	2,5	746	477.0	477.0	36	· "	0.00050	29.4		85.0	95.0	1431
	36000 PAH	¥ a	WAI	SAME			20.0	2 4 4	900	273.3	275.0	SPEC	~	0.00050	18.2		85.0	95.0	825
3 8	30000 201	j 0	ğ	SAME			52.8	44.0	260	95.3	95.5	110			15.0 S		1	1	1
3	36014 SEB/SG	EB/SGI	WAT	Ž			53.3	49.8	328	47.8	48.0	0	£	0.00050	15.0		85.0	104.3	\$
24	36014 SER/SGI	FR/SGI	WAT	SiM			49.8	44.0	328	79.3	96.2	SPEC		0.00050	26.0		85.0	95.0	202
25	39015 SER/SGL	ER/SGL	WAT	SAME			58.0	49.5	1695	600.3	631.0	209	-	0.00050	0.4		85.0	95.2	7 1695
i	39015 SE	SER/SGL	WAT	SAME			49.5	45.0	1695	529.7	584.0	471	-	0.00050	0.4		85.0	94.0	CEOL .
56	39043 SE	SER/SGL	WAT	SAME			56.1	49.1	1906	555.9	560.0	SPEC	•	0.00050			85.0	20.00	0001
	39043 SE	SER/SGL	WAT	SAME			49.1	45.0	1906	563.9	260.0	SPEC	- 1	0.00050	9.0	0.00	85.0	0 0	200
27	41003 SC	SGL	WAT	SAME	ν,	36.5	54.3	43.0	482	226.9	227.5	SPEC	e .	0.00050	20.2	105.0	85.0	95.0	26
28	42000 S(SGL	WAT	SAME			52.0	42.0	502 G	209.2	209.0	(e)	23	0.00050			83.0	93.0	20
53	50001 SC	SGL	AIR	SAME			53.6	44.0	323	129.2	129.2	ର :	•	0.00050	15.0		1 5	1	2
30	50004 P	PAR	WAT	SAME			29.0	45.0	215	125.4	125.0	<u> </u>	N (0.00050	0.9		0.00	0.00	27.0
	50004 P	PAR	WAT	SAME			29.0	45.0	215	125.4	125.0	(X)	OI (0.00050	6.0		95.0	0.00	0.70
	50004 P/	PAR	WAT	SAME			59.4	45.0	208	124.8	125.0	(5)	N	0.00050	N C		0.00	0.00	4422
3	87018 SE	SER/SGL	WAT	SAME			58.0	49.4	1422	509.6	512.0	בייני בייני		0.00090	9 0		0.50	9.00	153
	87018	87018 SERVSGL	WAT	SAME			4.00	42.0	1422	438.5	436.0	SPEC	•	0.00000	ń		3 1	;	! !
8	91001 SGL	ig i	AIH	SAME			32.3	44.0	440	161.0	0.121	27.50							

APPENDIX D

Table D-1. Chiller Nameplate and Field Measured Data

EVAP PERF	LWT	u.	53.4	47.5	49.8	50.5	44.0	46.0	49.3	47.0		46.5	44.7	46.6	OFF	47.5	47.8	45.1	43.5	47.0	9.09	49.5	47.0	46.0	44.4	44.7	2.14	5 C	45.0	40.5		52.7	46.0	OFF	8.73	OFF	45.0	47.3	47.7	57.0	OFF	54.0	44.0	
EVAP PERF	EWT	u.	56.0	49.0	51.2	54.2	54.0	56.0	50.9	55.7		51.6	51.6	51.6	OFF	52.0	55.2	51.6	53.7	60.0	57.7	59.3	51.6	48.0	53.3	50.4	0.04	OFF OFF	49.7	50.2		95.0	52.0	OFF.	61.7	OFF	51.8	48.9	50.0	62.0	OFF	0.09	47.0	
EVAP	SHT	ш	47.3	41.5	49.3	44.4	39.0	39.0	42.6	42.6		64.2	37.8	34.4	OFF	44.6	26.7	35.3	35.6	40.1	35.6	37.8	44.6	41.6	43.6	43.7	4.04	9.05 T	42.8				48.9	OFF	53.1	OFF	36.7	46.2	33.8	35.3	OFF	44.6	38.5	
			Đ.	PSIG	PSIG	PSIG	PSIG	PSIG	Ę.	HG		Ä	PSIG	PSIG		÷	ä	Ä	PSIG	PSIG	PSIG	PSIG	Ä	Ÿ.	PSIG	PSIG	¥ 2	Y OF	PSIA				Į.		Ä		PSIG	Ę.	PSIG	Ę.		ij.	Ÿ.	
EVAP PERF	SRP		-13.0	67.5	83.0	41.0	36.0	36.0	-24.0	-24.0		-20.0	35.0	32.0	OFF	-14.0	-26.0	-25.0	33.0	37.0	33.0	35.0	-14.0	-15.0	74.0	74.2	: ;	- 1	7.5				-12.5	OFF	-15.0	OFF.	34.0	-13.5	60.0	-17.0	OFF	-14.0	-16.0	
COMP	FL EFF	KW/TON	0.855		0,900 E	0.873	0.718	0.718		0.900 E	1.000 E	0.924	0.919	0.919	0.712	0.712	0.850	0.851	0.874	0.877	0.773	0.773	0.781	0.917	0.654	0.654	0.625	0.010	0.673	1.000 E	1	0.911	0.726	0.784	0.809	0.807	0.875	606.0	1.000 E	0.888	0.888	0.752	0.781	
COMP	POW	ΚW	171.0	66.2	49.4	199.0	79.0	79.0	134.8	160.2	71.6	157.0	193.0	193.0	121.0	121.0	119.4	124.2	188.0	408.0	85.0	85.0	400.0	400.0	301.0	301.0	2000	376.0	185.0	95.5	N N	97.6	458.0	458.0	453.0	452.0	199.0	190.0	129.2	111.0	111.0	94.0	400 0	9
COMP	POW	모		75		250							273	273	154	154			250	200	135	135			384	384	318		233		2		585				220		148			115		
COMP	CUR	LR.	1179 D		550 D	1515 D	488 D	488 D		۵		1275 D	458 Y	458 Y	1059 D	1059 D	980 D	980 D	1300 D	2520 D	634 D	634 D	3120 D	3120 D	311	3111	3240	2371	1950 D		46	760 D	3560	3260	3470 D	3560 D	1300 D	2673	۵	653	653	630	3120 D	
COMP	CUR	Fζ	225	190	142	265	110	110	175	218	73	212	257	257	166	166	183	183			120				439	439	340	530			80	140	609					589	99	148	148		501	
COMP	POT	VOLT	480	208	208	460	460	460	440	460	480	480	480	480	460	460	460	460	480	480	460	460	480	480	460	460	004	460	460	200	480	460	460	460	480	480	480	208	460	480	480	480	480	
COMP	STARTER	ITPE				CLOSED-TRANS STAR-DELTA			STAR-DELTA			CLOSED-TRANS STAR-DELTA	OPEN-TRANS STAR-DELTA	OPEN-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	SOLID STATE	SOLID STATE	SOLID STATE	CLOSED-TRANS STAR-DELTA	SOLID STATE RED VOLT			PART-WINDING	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	CLOSED-TRANS STAR-DELTA	OPEN-THANS STAR-DELTA	OPEN-TRANS STAR-DELTA		OPEN-TRANS RED VOLT	OPEN-TRANS RED VOLT	SOLID STATE	CLOSED-TRANS STAR-DELTA							
COMP	IMP 3	<u>\$</u> ≥										26.5					56.0	26.0					29.0	30.0									27.0	28.5		30.0							29.0	
COND	WPD	FT	2.9			16.8	7.3	7.3			1	50.0	10.8	10.8	17.7	17.7	17.5	17.5	18.2	19.2	12.6	12.6	16.1	16.1	19.7	19.7	7.0	23.4	18.2	I	6.2	9.0	13.0	13.0	20.0	12.1	19.3	18.2		16.0	16.0	24.2	16.1	
COND	FOUL	TAC.				0.00050	0.00050	0.00050				0.00050	0.00100	0.00100	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00025	0.00025	0.00025	0.00050	0.00050	Different desails	0.00050	0.00050	0.00050	0.00050	0.00100	0.00100	0.0000	0.00100	*******	0.00050	0.00050	0.00050	0.00050	
COND	PASS		-			2	8	2			1	ZPH	2	63	2	7	2LH	2LH	8	ø	cv.	8	SCH.	2LH	N (N 6	4 0		8	1	2RH		S.H	H :	ZH.	품 '	N	8	1	8	2	7	2H	
COND	CALC	TONS	242.5	9.68	!	282.1	133.4	133.4		1	1	203.0	263.9	263.9	208.3	208.3	168.4	175.2	264.7	569.5	136.1	136.1	592.5	592.5	540.5	470.5	470.0	5963	343.8	1	51.5	85.0	720.4	635.6	686.0	686.0	280.4	261.3	1	156.3	156.3	156.3	592.5	
BLDG	2		121	135	135	194	410	410	2805	5764	5764	5792	7050	7050	7051	7051	14020	14023	21002	27004	28000	28000	29005	29005	31008	36008	36000	36000	36006	36009	36014	36014	39015	39015	39043	39043	41003	42000	50001	50004	50004	50004	87018	
₽ 8		1	-	7		က	S		9	7		8	6		9		13	4	5	16	11		8	;	<u> </u>	3 5	7		83	23		54	52		56	į	12	58	8	30		;	3	

APPENDIX D

Table D-1. Chiller Nameplate and Field Measured Data

	İ	cun,	AMP																											90	8							2	5						
			AMP																											90	8							č	ō						
			₽₩																											90	P P							8	3						l
	OMP P		AMP ,	8	9	72	110	44	9	9	5	8	8 8	3 5	מ מ	- u	2 0	100	5 6	195	8	130	105	9	287	216	287	88 F	1 5	2 6	3	95	251	OFF	55	OFF.	28	382	4	8 2	5	2 5	220	5 =	
			AMP /	78	28	72	5	44	9	9	5	ŕ	82	2 2	הומ	֓֞֜֜֜֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֓֓֡֓֓֡֓֓֓֡֓֡֓֡֓֡֓	9 6	8 8	168	195	8	120	501	00	293	218	596	8 5	1 5	001	3	85	251	PFF	55	PF.	180	500	- :	9 L	5;	2 5	2 2	5 5	
	1		AMP /	7	55	72	110	44	9	9	₽														301																			5 5	1
COMP			SEIPI %	88									8	8	9																			9				YES	i	2		Č	3		
COND		LOAD	TONS	1	-		1	•	1		1	l	1			2 204	0.70	100	205.8	262.5	79.1	2.66	*****	1	261.6	1	488.7	531.4	5	99		102.7	***		-		216.0	81.0		•	*****				
COND		FLOW	GPM						130							9	2 5	46.	78.0	1260	345	230	i		860		1466	1466	1/48	92	1	290				i	2	720						i	
COND (WPD	Ħ	o	12	1	8	2	9	36	4	ı	1 ;	8 9	2	1 9	<u> </u>	3 8	2 6	3 7	5 ~	· e	24	23	1	7	o	8	ì	:	2	, on	39	1	1	8	2	ន	I	ŧ	1 ;	E :	2 :	<u> </u>	
COND		LWP	PSIG	7.0	00	CANT	19.5	24.0	25.0	5.5	10.5		CANT	0.1	ייי מיי	ב נ ס	0 0	n u	0 0	2 4	14.0	22.5	12.0	11.5		5.0	18.5	16.5	5 5	NOIE	1	8.5	12.0	CANT		13.5	8.5	13.5	!		;		0.4	2	
COND		EWP	PSIG	11.0	13.5	20.0	28.0	26.0	27.5	21.0	16.5		28.5	19.5	5. C	5;	4. C	2.0	2.60	27.0	15.0	24.0	22.5	21.5		14.0	22.5	26.0	5	NO	l	12.5	29.0	CANT		28.0	19.0	23.5	i			23.0	22.0	2.5	
COND		LWT	ı	79.8	84.5	83.4	85.6	96.6	82.0	77.8	87.5	;	82.9	86.0	2 G	5 8	2.20	7.00	9 6	0.70	87.1	623	77.77	74.0	90.6	84.2	89.5	90.0	F 5	88.3	1	88.3	81.2	OFF	74.5	OFF	92.8	79.4	•	85.1	10	83.7	į	5	
COND		EWT	и.	78.0	77.6	79.7	83.0	81.2		75.5	83.5	i	79.9	91.0	2. C	ב ב	7.00	4.70	U. 10	0.00	9. 6	2 6	73.8	71.7	83.3	79.9	81.5	81.3	4	81.0	!	79.8	79.7	OFF	70.7	OFF	85.5	76.7	!	81.0	9	77.4	Ĺ	5	
COND		SRT	ш	78.0	88.0	85.5	89.0	96.1	87.1	85.5	99.0		105.5	98.9	98.9	5	5.5	2.18	0.00	0.00	108.0	115.2	90.1	84.3	92.2	84.6	91.4	94.0	9	91.9			85.8	OFF	81.2	OFF	104.3	87.2	97.0	100.3	PF	100.3	87.2	ļ <u>:</u>	
				PSIG		PSIG	PSIG	PSIG	PSIG	Ë	맞		Į.	PSIG	25.0		200	2 9	5 G	2 0	000	000	PSIG	PSIG	PSIG	PSIG	PSIA	PSIA		PSIA			PSIG		PSIG		PSIG	PSIG		PSIG		PSIG	PSIG	Č	2
COND	i	SRP		-	2	157.0	98.0	110.0	95.0	-14.0	-9.0		9.0	115.0	115.0	5	0.0	12.0	-10.0	7 00	123.0	147.0	5.0	3.0	174.3	154.9	20.2	21.2	OFF.	20.4			9	9.P.	2.0	OFF	125.0	4.0		0.6	P.	0.6	0.5	2 6	200.0
EVAP	: i	ACT	LOAD	1		60	75.5	100.0	109.2	į	174.7	1	97.1	237.2	171.9		154.7	5.55	0.88.0	0.0	. F 49	2.5	304.8	132.5	452.4	248.2	1	1		177.2	į	67.4	602.5		354.3		199.8			I		95.5	202.5		
EVAP		FLOW	GPM			143	490	240	262		482		457	825	852	825	825	325	352	45	000	20.5	1590	1590	1220	1045				902		200	2410	2410	2180	2180	705				430	385	1620	1620	
EVAP		WPD	표	2		:	1	7	4	18	1	ı	2	5	5	9	8	8 3	24 5	2 8	9 4	2 5	. 2	5	<u>.</u> 1	53	12	45	t	15	12	46.	2	. o	12	6	8	24	1	12	16	4	о	υ ć	2
EVAP		LWP	PSIG	25.5	A A A P.T.	LAN	CANT	23.0	20.0	51.0	CANT		19.0	45.0	35.5	24.0	31.0	55.0	25.5	36.0	37.0	2 5	83.0	910	2	16.0	85.5	84.0	OFF	80.0	20.0	48.0	20.0	62.0	75.0	72.0	33.0	45.5	CANT	39.0	38.0	40.5	68.0	76.0	60.0
EVAP	: i	EWP	PSIG	2.0	1	LNAC	CANT	26.0	26.0	59.0	CANT		23.5	47.0	45.0	31.0	39.5	63.5	36.0	44.0	2000	0.00	88.0	0 96	8	39.0	90.5	102.0	95	86.5	75.0	0	25.0	0.99	80.0	76.0	41.5	56.0	17.5	44.0	45.0	46.5	72.0	0.0	21.0
F 0	0			5	100	136	194	410	410	2805	5764	5764	5792	7050	7050	7051	7051	14020	14023	21002	2/004	2000	20005	20005	31008	34008	36000	36000	36000	90096	36009	36014	30015	39015	39043	39043	41003	42000	50001	50004	50004	50004	87018	87018	91001
PLANT NO RID		•		-	- ‹	ų	er	y un)	9	7		60	6		2		5	4 :	ξ.	9 1	=	4				72			23			5 5		58			28					31		35

APPENDIX D

Table D-1. Chiller Nameplate and Field Measured Data

2	5 0 8 0	
-	121	SOHEM EVAP GPM = 362 PERE FLA = 226
~	135	35 BUILT UP UNIT SEVERE SPREAD IN AMP READINGS IS 80.78410 W/s PSI DRIET SI ICT DRESS
	135	38 EEAP RPT DOES NOT LIST 2nd CHILLER
6	194	SO VOLT = 440. SO FLA = 290. SO LRA = 1450 D
S	410	
	410	
9	2805	2805 USES GLYCOL TO 18F, REBUILT 79/80
7	5764	PROJECT LOCATION & SERIAL NO CONFLICT. APPROX 1700 LBS OF REFRIG CANS IN ROOM, CALC EVAP FLOW PRO-RATED
	5764	EEAP RPT LISTS 2nd CHILLER BUT DOES NOT INCLUDE DATA
80	5792	SO VOLT = 460, SO FLA = 218, SO LRA = 1218, 16 GPM CLG, CONTROLS ARE "DELICATE"
6	7050	SCHED TONS = 208.5, CALC EVAP FLOW SPLIT EQUALLY
	7050	SCHED TONS = 208.5, CALC EVAP FLOW SPLIT EQUALLY
9	7051	ACTIVE/REDUNDANT CONFIG ? OFF, PROBABLY DUE TO LOW LOAD
,		ACTIVE/REDUNDANT CONFIG ?
2	14020	SO VOLT = 480, SO FLA = 161.4, SO LRA = 1025
4		SO VOLT = 480, SO FLA = 167.8, SO LRA = 1025
5		SCHED COND GPM = 623, OIL LEAK
9		SO LISTS 2 UNITS, SO FLA = 546
17	28000	
	28000	
2	29005	29005 MODEL & SERIAL REVERSED W/ OTHER UNIT, SO & ORIG FLA = 562, 4 GPM CLG
		MODEL & SERIAL REVERSED W/ OTHER UNIT, SO FLA = 362 & 562, ORIG FLA = 362, 4 GPM CLG, OVERHAULED '91
6	_	SLIDE VALVE @ 53%, AMPS @ 68%, OP HRS = 4736
ខ្ល		
_		SO VOLT = 480, AMPS @ 85%, CALC COND FLOW PRO-RATED ASSUMING FLOW THRU DEAD CHILLER (TYP THIS BLDG)
		EXCESS PURIOR, AMPS @ 87%, CODE-KIT ADDED '93, SEE AUSTIN FOR ORIGINAL NAMEPLATE
,		SPECO W/ HOLI GASS, CODE-KIL ADDED XX / OFF BECAUSE FILLED W/ AIR
3 8		EXCESS PUNCE, PEHF VOL. # 480, PEHF FLA # 258, PEHF LAA # 2035, AMPS @ 67%, 2nd PASS EWP/LWP # 14.0/5.0
2		CENTS, MEAS AMPS TOH COMPS 1 & ZAND COMPS 3 & 4
,	36014	HOLI WATER SOUNCE; SO EWILVIN = 48 JOHN 4, EEAP HPT DOES NOT LIST ZAG CHILLER
ŧ ;	1000	THE LESS AND BUILD ALL BUILD WAS IN SOCIED TONS A FAUL EWPLING TO 12:3/8.5 & 12:3/8.0 FOH 2 COND IN PAR
n	39015	SCHED TONS - 600, OHIGH IN A 600 OHIGH OF A 600 OHIGH OF
96	39043	OBJECT TOWN SOLD SHIP AS SOLD BY A SEASON OF SOLD SOLD SHIP SOLD SOLD SHIP SOLD SHIP SOLD SHIP SOLD SOLD SHIP SOLD SOLD SOLD SOLD SHIP SOLD SHIP SOLD SOLD SHIP SOLD SHIP SHIP SOLD SHIP SHIP SHIP SHIP SHIP SHIP SHIP SHIP
,		OFFICE TOOL TELEFORM OFFICE A FAR SO THAT SAYS OFFI TO LOW LOAD
7		SCHED COUNTY GRANT GOVERNMENT COUNTY GOVERNMENT GOVERNM
28		NO LOAD DUE TO REMODEL. USES GLYCOL TO 75. GLYCOL NOT SPECID ON SO
83	50001	2 CKTS, MEAS AMPS W/2 COMP'S ON
0	50004	NAMEPLATE PAINTED OVER
		SPEC'D W/2-UNIT SEQ KIT, OFF DUE TO ELECTRICAL PROBLEM
	50004	SPEC'D W/3-UNIT SEQ KIT
3	87018	87018 ORIG MODEL = C2D2, SO & ORIG FLA = 562, 4 GPM CLG, MOTOR REPL'D 77, 100 LB R-11 ADDED
	87018	87018 ORIG MODEL = C1D1, ORIG FLA = 562 ? 4 GPM CLG, OFF DUE TO UNKNOWN PROBLEM

APPENDIX D

Table D-2. Chiller Reference Data From EEAP Report

COMP	Pow	×	66.86	20 Z	85.10	59.10	57.47	42.82	121.50	Z S	5.50	150.40	97.55	84.00	53.00	66.36	142.40	51 13	49.51	149.90	322.00	252.60	132.10	94.8	202.60	70.50	197.70	Z	76.11	263.41	276.30	231.90	131.40	27.66	46.36	58.00	63.69	57.53	140.00	104.40	24.75
COND	LOAD	TONS	2.2	0	101.2	117.0	111.0	28.1	162.2	1	33.5	141.6	194.9	161.3	77.8	88	176.7	2/4/2	0.00	261.6	500.0	382.6	139.1	250.0	287.4	122.4	I	•	83.5	400.6	424.3	305.3	171.4	57.9		91.7	98.1	68.3	203.8	323.9	
COND (FLOW	GPM	602	2 2	485	333	324	278	438	H	4 2	737	584	512	340	241	203	953	252	763	1500	1279	795	1200	1746	483	I	Z	191	1131	1180	1549	539	404	i	488	279	396	1075	è l	
COND (WPO	ᇤ	52	1 1	t	7	· w	ន	28	1 ;	នុខ	3 %	1	1	32	32	1 8	8 7	<u>†</u> 1	99	16	1	၉	1 8	5	1	t	ı	18	1	1 1	32	1	28	1	52	58	45	9	1 1	
COND (LWP	PSIG	- ;	ξZ	Ž	23	75	6	0	1 1	2 5	ž č	Y X	¥	15	o :	Ž,	4 ţ	- 2	=	13	¥	S	¥.	C 4	C C	1	Ž	4	₹ S	ξ 4	8	ž	6 0	1	Ξ	2	co :	4 4	ž I	
COND	EWP	PSIG	9 5	₹ Z	Ž	26	56	19	83	1 ;	8 8	3 %	ž	A	9	ี 8	¥:	<u>4</u> €	3 8	3 8	8	Š	18	χŽ	\$ 8	χ×	1	Z	12	ž	ž S	3 5	¥	8	1	ឧ	8	92		Q 1	
COND	LWT	u	81.03	93.36 Z	90.89	88.84	88.63	80.62	97.40	1	86.78	91.01	88.42	85.14	82.57	88.84	88.63	91.73	92.33	88.84	82.05	86.37	90.89	89.66	92.74	87.40	I	Z	98.40	93.77	93.30	84.73	89.45	80.62	1	17.	89.25	86.37	86.58	91.10	
COND	EWT	ш	78.19	85.27 N	85.88	80.41	80.41	78.19	88.51	1	81.82	80.78	80.41	77.58	77.08	80.00	80.20	83.24	64.03	80.61	74.05	79.19	86.69	84.66	83.45	81.32	1	Z	87.91	85.27	20.00	80.00	81.82	77.18		79.60	80.81	82.23	82.03	82.03	
EVAP PERF	ACT	TONS	56.3	26.0	61.3	76.6	67.8	21.5	126.4	1	0.0	2. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	135.1	110.1	49.9	64.2	127.8	167.0	0.50	167.7	321.3	270.1	71.8	189.6	390.6	91.5	92.5	1	62.1	279.0	201.4	242.5	129.8	39.7	27.6	62.9	78.8	65.3	109.4	244.5	2
EVAP PERF	FLOW	GPM	375	167 Z	369	28	167	159	324	Z	588	512	369	312	243	262	497	873	407	810	1000	904	530	857	1008	545	315	Z	242	1285	244	4	8	494	270	230	167	298	1215	1215	213
EVAP PERF	WPD	ᇤ	t	1 1	1	5	1 5	18	1	1	52	4 4	1 19	. 1	5	23	on :	8 8	Z 8	3 2	, o	თ	4	ı	1	1 1	16	1	37	t	: 5	ŭ 0	1	52	1	42	6	7	_ '	- 1	1
EVAP PERF	LWP	PSIG	¥:	Ž	2	9	2 2	43	¥	Z	5													ž:									ž	35	NA.	37	4	4	2.5	55 2	ž
EVAP PERF	EWP	PSIG	18	¥ Ž	42	24	25	5				2 2	8 8	A	65	45	51	ੜੇ 8	8 8	3 8	9 6			124				_						46	27	42	45	20	8 8	8 8	-
EVAP PERF	LWT	ıL						•	•	z	•	42.27	. 4	4	4	•	44.93	•	•	4	, 4,		•	44.14	•			_		•	•	47.89		•	4	44.93		59.17	47.70	47.50	48.00
EVAP PERF	EWT	Ŀ	51.10	44.32	45.06	F1 F1				Ē	51.71	46.58	52.74		•					53.90				•		53.97			56.23	52.12	53.97	20.90	52.53	•	•		•	_	49.86	52.33	20.04
COMP	FL EFF	KW/TON	0.905	0.900	679.0	27.0	0.718	0.900	0.879	Z	0.867	0.880	0.710	0.710	0.891	0.891	0.874	0.877	0.773	0.730	0.830	0.849	0.877	0.769	0.610	0.860	1,450	Z	0.870	0.710	0.790	0.799	0.873	0.900	1.280	0.830	0.830	0.750	0.761	0.852	1.410
COMP	POW	ΚM	174.7	4.4	1001	70.07	79.0	135.9	156.5	•	156.9	168.1	106.5	106.5	143.5	143.5	187.9	407.8	85.0	360.0	362.7	366.8	407.8	289.9	244.0	408.5	147.9	-	85.3	458.0	460.6	461.0 £28.0	199.0	189.0	174.1	9.66	9.66	93.8	356.1	356.1	1/3.4
EVAP	CAP	TONS	193.0	71.5	2 0	1100	100	151.0	178.0	Z	181.0	191.0	150.0	150.0	161.0	161.0	215.0	465.0	110.0	2000	437.0	432.0	465.0	377.0	400.0	975.0	102.0	ž	98.0	645.0	583.0	5/7.0	228.0	210.0	136.0	120.0	120.0	125.0	468.0	418.0	123.0
EVAP FLOW			VAR	CONST	F 1010	Tokio	CONST	VAR	CONST	CONST	VAR	CONST	CONST	CONST	VAR	VAR	VAR	VAR	CONST	SNO SNO SNO SNO SNO SNO SNO SNO SNO SNO	VAR	VAR	VAR	VAR	VAR	VAH	VAR	CONST	CONST	VAR	A .	A 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	A A	CONST	VAR	CONST	CONST	CONST	VAR	AA S	AH
HAP LOAD		TONS	138	25	2 5		2 5						2 5		75	166	240	486	119	91.	384	458	485	362	362	431	110	Z	96	509	471	2 2	3 2	189	129	102	102	102	487	415	123
OPER SCHED		HRVR	SEAS	SEAS	0410	0410	SEAS	SEAS	SEAS	SEAS	SEAS	YEAR	YEAR	YEAR	SEAS	SEAS	SEAS	SEAS	SEAS	SEAS	SEAS	SEAS	SEAS	YEAR	YEAR	YEAR	SEAS	YEAR	YEAR	SEAS	SEAS	SEAS	SEAS	SEAS	YEAR	YEAR	YEAR	YEAR	SEAS	SEAS	SEAS
F.S.		Ī	9/	22	, =	2 3	\$ 3	\$ 2	8	Z	7	8 8	29 K	8 8	78	78	71	7	83	£ 53	5 12	2 2	74	8	80	3 8	22	Z	85	75	75	8 2	2 9	2 2	23	¥	¥		72	27 5	2
DWG YR			65	22	₹ ₹	2 8	2 2	3 6	Ş Y		74	8	2 2	8 8	78	78	70	72	83	8 2	5 %	2 2	2	2	3	98	22		82	75	75	8 2	2 2	. 2	73	82	82 NA	82	75	22	76
PLANT		TONS	193.0	71.5		0.822	220.0	1510	178.0		181.0	382.0	000	9	161.0	161.0	215.0	465.0	220.0	001	937.0	432.0	465.0	1252.0		0 100	1020		98.0	1228.0		1192.0	0 900	2100	136.0	365.0			886.0		123.0
PLANT HAP	LOAD	TONS	138	25	,	200	88	116	143		176	306	450	8	75	166	240	486	238	0	929	458	485	1155		0	1 6	2	96	980		1084	222	180	2 5	306			805		123
PLANT	2		121	135	135	3 :	410	2005	5764	5764	5792	7050	7050	7051	14020	14023	21002	27004	28000	28000	20002	31008	34008	36000	36000	36000	36000	36014	36014	39015	39015	39043	39043	2000	5000	50004	50004	50004	87018	87018	91001
PLANT			-	2	•	יפי	n	ď	۸ ه		60	თ	ç	2	13	4	15	16	17	•	20	9	2 6	2 2		1	3 8	3	24	52		56	ć	2 6	8 8	3 8	3		31		35

APPENDIX D

Table D-3. Cooling Tower Nameplate and Field Maesurement Data

							accessions and				
PLANT	PLANT	(B	MODEL	SERIAL	•	α	FIL	FILL			FAN
<u>Q</u>	BLDG NO		ON	ON.	CAP	TYPE	TYPE	CONDITION	CONDITION	QTY TYPE	CONFIG
					TONS						
-	121 MARLE	TLEY	NC	8807-4-194-79	250 7	250 OPEN				1 PROP	ID CROSS
N	135 MARLEY	3LEY	AQUATOWER - VERT	4633-1288	75 (75 OPEN		POOR		1 PROP	-
	135 MARLEY	JLEY	AQUATOWER - VERT	4740-150	40 0	40 OPEN				1 PROP	ID CROSS
e	194 PRT	194 PRTCHRD or GDFLLW			_	OPEN				1 PROP	_
ιΩ	410 ALAMO	MO			_	OPEN	MASONARY				_
9	2805 GOC	2805 GOODFELLOW	PVMA175	78-1078	•					1 PROP	ID CROSS
7	5764 BAL	BALTIMORE AIRCOIL	2415C	83-4634-D		OPEN	PVC	SOME CA		1 PROP	ID CROSS
ω	5792 PRI	5792 PRITCHARD-ECO	1-X708-6	PXA-8376-74		_	WOOD SLAT	CA ON METAL, APD DK		1 PROP	_
o	7050 BAL	7050 BALTIMORE AIRCOIL	2415-C	81-2727-D		OPEN		CA & ALGAE	SOME ALGAE	1 PROP	ID CROSS
	7050 BAL	7050 BALTIMORE AIRCOIL	2415-C	81-2726-D	Ü	OPEN		CA	SOME ALGAE	1 PROP	ID CROSS
10	7051 BAL	BALTIMORE AIRCOIL	3547	85-6716-D	0	OPEN		OK OK	OK	1 PROP	ID CROSS
	7051 BAL	BALTIMORE AIRCOIL	3547	85-6717-D		OPEN				1 PROP	ID CROSS
13	14020 BAL	4020 BALTIMORE AIRCOIL	FXT-173C	89400991	0	OPEN			LOTS ALGAE	2 PROP	FD CROSS
14	14023 BAL	14023 BALTIMORE AIRCOIL	FXT-173C	89400344		OPEN			LOTS ALGAE	2 PROP	FD CROSS
15	21002 MARLEY	JLEY	NCII	8908-4-787-85	300	OPEN	PVC	SOME CA & ALGAE	SOME ALGAE	1 PROP	ID CROSS
16	27004 HAVENS	ENS	M-48-500	CO-722332	0	OPEN		SOME CA	OK OK	1 PROP	ID CROSS
17	28000 ALAMO	MO			0	OPEN	MASONARY		ALGAE ON BOT		ID COUNTER
18	29005 PRII	29005 PRITCHARD-ECO	1-Y1516-7 TOWER B	PYA-7723-73	0	OPEN	PVC	SOMECA	ALGAE	1 PROP	ID CROSS
6	31008 MARLEY	1LEY	NO.	8816-4-1216-83	8	OPEN	PVC	SOMECA		1 PROP	ID CROSS
50	34008 HAVENS	ENS	M-48-500	CQ-722332	Ü	OPEN	PVC	LOTS CA & ALGAE		1 PROP	ID CROSS
21	36000 MARLEY	J.E.Y	DOUBLEFLOW (373 ?)	4678-82	¥	NA OPEN				2 PROP	ID CROSS
	36000 MARLEY	J.EY	DOUBLEFLOW 365-102	4-1569-80	440 OPEN	DEN		QUITE FOULED		2 PROP	ID CROSS
23	36006 MARLEY	ILEY	NO	8808-4-821-78	300 OPEN	DEN		LOTS CA ON LEAD EDGES		1 PROP	ID CROSS
ឌ	36009 CAR	CARRIER	NA (INTEGRAL)	NA (INTEGRAL)	U		NA	NA	NA	2 PROP	ID CROSS
54	36014 MARLEY	1LEY	AQUATOWER - VERT	603944AX321	160	OPEN		GOOD		1 PROP	ID CROSS
52	39015 EVA	EVAPCO	LSTA-10-364	893829	J				SEAMS LEAK	9 CENT	FD COUNTER
56	39043 SITE	SITE-ERECTED	TWO-CELL		0	OPEN	FIBERGLASS	OK OK	oK OK	2 PROP	ID COUNTER
27	41003 MARLEY	lley .	NCII	8908-4-788-85	98	OPEN	PVC	SOME CA & ALGAE, APD OK	ALGAE	1 PROP	ID CROSS
58		BALTIMORE AIRCOIL	2417C	83-4635-D	U	OPEN	PVC	SOME CA, NOT BAD	ALGAE	1 PROP	ID CROSS
53	50001 CAR	CARRIER	09DE084600	U396035	J		NA	NA	NA VA	6 PROP	ID CROSS
	_	CARRIER	09DE084600	U396034	U		¥	VA.	AA	6 PROP	ID CROSS
ස		TRI-THERMAL	MT-70147	20-67-91	O	OPEN				1 PROP	ID CROSS
	50004 TRI-	TRI-THERMAL	MT-70147	20-67-91-1	U					1 PROP	ID CROSS
	50004 BAL	50004 BALTIMORE AIRCOIL	2413C	82-4040-D	O					1 PROP	ID CROSS
3	87018 PRI	87018 PRITCHARD-ECO	1-Y1516-7 TOWER A	PYA-7723-73	O		PVC	SOMECA	LOTS ALGAE	1 PROP	ID CROSS
35	91001 CARRIER	RIER	NA (INTEGRAL)	NA (INTEGRAL)	٥	QNOC			NA	10 PROP	ID CROSS

DSGN

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.75 & .71 .75 & .71 10 10 482 482 383 Ę FRAME 326T 254T 213T 254T 364T 254T 254T 254T 213T 215T 364T 145T 256T 77513-77613LR1RV 1M0478396-G2-VC SERIAL NO 36N04-1868 51-305-629 5K215BC205A M7042T MODEL (CAT, PRT) NO 2V8100-627 0.90 DELCO 0.60 0.60 0.35 VANGUOUT & SIEMENS 0.80 ALLIS CHALMERS 0.38 0.40 0.81 Table D-3. Cooling Tower Nameplate and Field Maesurement Data PERF MOTOR MFG
MEAS
APD
IN WG
0.00 BALDOH
0.70 LINCOLN
0.50 0.40 0.45 0.60 0.95 RELIANCE 0.90 0.25 MARATHON 0.40 RELIANCE RELIANCE CENTURY 0.30 0.55 0.30 0.50 0.70 0.55 PERF MEAS LAT WB F 81.0 82.0 83.0 81.0 82.0 79.0 79.0 79.0 83.0 72.0 77.0 PERF MEAS LAT DB F 76.1 85.0 83.0 76.0 82.0 82.0 82.0 84.0 83.0 78.6 82.0 77.0 75.0 109 64.0 5 66.0 77.0 72.0 78.0 74.0 77.0 75.0 73.0 74.0 72.0 76.0 76.0 73.0 PERF MEAS EAT WB F PERF PERF MEAS MEAS LWT EAT F DB F 68.0 90.0 79.0 85.0 85.0 92.0 77.0 90.0 90.0 83.0 65.0 84.0 90.0 77.0 84.0 88.0 79.0 89.0 90.0 80.0 83.0 81.1 NA 76.0 8. 5. A X 83.7 80.4 81.0 77.2 81.6 80.5 79.5 81.0 83.2 82.0 82.0 84.2 87.0 NA 89.0 91.0 82.1 NA NA PERF MEAS EWT 83.0 83.3 86.5 86.4 86.0 90.7 86.2 83.4 86.0 87.6 87.2 86.6 DISABLED NA DISABLED DISABLED SEEMS OK DISABLED STUCK STUCK DISABLED DISABLED INOPER? NA NA INOPER? DISABLED DISABLED SEEMS OK CTRL STATUS 121 NOT BYPASS
135 BYPASS
136 BYPASS
140
2805 NOT BYPASS
5764 NOT BYPASS
5765 NOT BYPASS
7050 BYPASS
7050 BYPASS
7051 BYPASS
7050 BYPASS
21008 NOT BYPASS
28000
29005 BYPASS
31008 NOT BYPASS
36000 BYPASS NA BYPASS BYPASS BYPASS NOT BYPASS BYPASS BYPASS BYPASS BYPASS PLANT CTRL BLDG TYPE NO 36009 36014 39015 39043 41003 42000 50001 50004 87018 91001 50004 22458788 32 34 PLANT 9

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7.5 7.5 30 & 15 40 & 10

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APPENDIX D

			CORRODED, FAN CYCLING	SING RUSTED W/ HOLES				IVE, OVERFLOW PLUGGED					OP, DRAINED DOWN	ac ac	NIT (PROBLEM ?)	NIT (PROBLEM ?)		у	AN DRY DURING TRIP	HING TO GROUND BOTH ENDS				TH FANS ON				TO 1 OF 3 CELLS CLOSED		JT OF BALANCE ?)		RECEIVES RECIRC FROM ADJACENT PROCESS CONDENSERS	RECEIVES RECIRC FROM ADJACENT PROCESS CONDENSERS			4	HING TO GROUND ONE END	INT CINE
ant Data	Y NOTES		SPLASH PLATES DISLODGED & CORRODED, FAN CYCLING	FAN DISCHARGING WATER, CASING RUSTED W/ HOLES	FANCYCLING	EXCESSIVE VIBRATION	INACCESSIBLE W/O LADDER	WATER FLOW SEEMS EXCESSIVE, OVERFLOW PLUGGED	SPLASH PLATES CORRODED				ALSO SERVES HEAT PUMP LOOP, DRAINED DOWN	ALSO SERVES HEAT PUMP LOOP	LOTS LOOSE NOZZLES ATOP UNIT (PROBLEM ?)	LOTS LOOSE NOZZLES ATOP UNIT (PROBLEM 1)		FAN APPEARS OUT OF BALANCE	INACCESSIBLE W/O LADDER, RAN DRY DURING TRIP	WATER DIST SUSPECT, SPLASHING TO GROUND BOTH ENDS	TOP INACCESSIBLE			APPEARS FULL BYPASS W/ BOTH FANS ON	WATER GREEN & FOAMY	LEAD SECTION DIRTY		PONY BELTS REMOVED, FLOW TO 1 OF 3 CELLS CLOSED		EXCESSIVE VIBRATION (FAN OUT OF BALANCE?)		RECEIVES RECIRC FROM ADJA	RECEIVES RECIRC FROM ADJA			INACCESSIBLE TO OBTAIN DATA	WATER DIST SUSPECT, SPLASHING TO GROUND ONE END	LEAD SECTION DIBITY SOME BENT BINS
Table D-3. Cooling Tower Nameplate and Field Maesurement Data	PRELIMINARY RECOMMEND		REPLACE				RETAIN			REPLACE	REPLACE	REPLACE			REPLACE	REPLACE			RETAIN	REPLACE									RETAIN								REPLACE	
Ψp	PERF	3 AMP					16.5				9.3	9.8	OFF							PFF																		
d Fie	PERF	AMP					17.0				8.9	9.5	OFF							PF0																		
e an	PERF	AMP					16.0				8.4	9.4	유							9F																		
eplat	PERF	VOLT					470				470	470																										
Nam	DSGN	%											86.5																					87.5				
Tower	_	FACT %	1.15	1.00						1.15			1.00				1.15			1.00					1.15		1.15							1.15			1.00	
Cooling	N DSGN CUR	FLA	3	3 8.6/4.3	3 7.1				၉	3			e				3 40.0/20.0			3		3	9	e	3 38.0/19.0	3 25.48.23.8	3 19.6/9.8	3	3 48.0&15.0	40.0/20.0		1 3.3	1 3.3	3 26.0/13.0	e		3 140.0/70.0	3 3.0
D-33.	DSGN																																					
Table	DSGN	VOLT	230/460	230/460	208		2		460	230/460			230/460				230/460		2	230/460		230/460	230/460	230/460	230/460	200	230/460	230/460	2 460	230/460		460	460	230/460	230/460		230/460	460
	DSGN MULTI SPD SPD	RPM	1740	1725	1720					1750			1730			0	1760			1770		1750	1770	1745	1750		1745		1755/875	1760				1740	1740		1770	
	PLANT	2	121	135	135	192	410	2805	5764	5792	7050	2050	7051	5	14020	14023	21002	27004	28000	29005	31008	34008	36000	36000	36006	36009	36014	39015	39043	41003	42000	50001	50001	50004	50004	50004	87018	91001
	PLANT		-	8		9	ĸ	9	7	80	on.		9	!	13	1	15			6	19	50	21		81		54	52	56	27	28	53		30			3	

APPENDIX D

Table D-4. Chilled Water Pump Nameplate and Field Measurement Data

PLANT	PLANT	MFG	MODEL [CAT, SPEC]	SERIAL NO	OPER SIZE SCHED	ORIENT	CPLNG	suct	FLOW CONFIG	FLOW CONFIG	EOP D YR F	DSGN DE FLOW HI	DSGN PI HEAD M	PERF PER MEAS CALO FLOW HEA	م را		PERF POW
	9		Q		ax an						U	GPM			*		BHP
	121	H PEEBI ESS	PB	315701	4380 3×4×10	HOH	SPLIT	END			88	68	٣	75	SANT	SANT	CANT
- 2	135		1531 : 318TB	1154565	4380 2.5 x 3 x 7	НОЯ	CLOSE	END	SYS-DED	CH-1/S	Y.	215	53	167	CANT	CANT	CANT
	138	135 PACO	15955: 1J-292-682	B2HY28483	4380 1.5 x 2 x 9.5	달 달	CLOSE		SYS-DED	CH-2/N	Z ;	Z ;	Z :	Z	Z 4	3 5	Z v
e		194 PACO	30125 : 3CC-LH62	DID22650	4380 3 x 4 x 12	¥ 9	SPLII	END	. 2	eve une	2 2	8 8	¥ 6	180	8 8	2 8	5. 4
2		410 AURORA	411-SF	84-02968-2	4380 2.5 x 3 x 10B	5 5	11100	190	N/1-10	DOLONO DOLONO	\$ 3	3 6	8 8	167	5 12	3 2	6.4
•		410 AURORA	411-SF	84-02368-1	4360 2.5 X 3.X 10B	5 5	SPLIT		מיים.		5 2	162	1 12	55	26	47	82
yo r		2805 BELL & GOSSETT	1510 : U-51191-488-91/Z-BF-FM	1259815.A58	4360 4 X F X 7	5 5	CLOSE	E S			82	00	92	2 2	CANT	CANT	CANT
- 6		A BELL & GUSSEII	1331 : 4BC-6//8-BF 11-30121-046201-18522 [2-D]	GKN11252	4380 3×4×12	<u> </u>	SPLIT	N O			74	457	85	288	105	67	11.5
20 0		5/32 FACO	11-30121-048201-18321 (1=D)	735665-1	8760 4 x 5 x 7		CLOSE	Q	SYS-HDR	CH-HDR	85	372	99	512	124	85	19.4
n		2050 WEINMAN	4625-2	735665-2	8760 4×5×7	HOH HOH	CLOSE	END	SYS-HDR	CH-HDR	85	372	99	512	124	85	19.4
10		1 TACO	BB5010-8.55-C5B-2HL1	B7873Y	8760 5 x 10	HOH	SPLIT	END	SYS-HDR	CH-HDR	82	408	22	369	67	2	9.0
•		TACO	BB5010-8.55-C5B-2HL1	B7873Y	0 5 x 10	면	SPLIT	END	SYS-HDR	CH-HDR	82	408	24	312	29	65	1.
13	•	20 PACO	11-30951-133201-1782	BNS08123	4380	된	SPLIT	END			78	536	82	243	8	72	7.6
4		23 PACO	11-30951-133201-1782	BNS08124	4380		SPLIT	SS			78	305	82	262	88	12	9.0
5		DUNHAM-BUSH	B9TC-1	42614	4380 3	된	SPLIT	ENO.		•	7	474	87		2	11	13.6
16	27004	Z			4380		CLOSE	END O	SYS-DED	CH-HDH	74	519	3		CAN	CAN	CAN
		PACO	10-40705-130001-182	EKN15020-B	4380 4×5×7	된	CLOSE	ENO	SYS-DED	CH-HDR	4	551	2		CANT	CAN	CAN
17		28000 PACO	29-20951-720061-A02-1	GTMF00446-B	4380 2 x 2.5 x 9.5	된	SPLIT	DBL	CH-1/N	SYS-HDR	8	8	8	214	3 i	8	9.
	28000	DO PACO	29-20951-720061-A02-1	GTMF00446-A	4380 2 x 2.5 x 9.5		SPLIT	DBL	CH-2/S	SYS-HDR	83	22	8	187		\$	5.4
18	3 29005	DS AURORA	411-BF	73-7739-1	4380 4 x 5 x 15	면	SPLIT	DBL	SYS-HDR	CH-HDR	22	Ξ	120	453	183	63	33.2
:		35 AURORA	411-BF	73-7739-2	4380 4 x 5 x 15	HOH	SPLIT	OBL OBL	SYS-HDR	CH-HDR	75	7	2	453	183	2	33.2
19		38 PACO	10-40127-1A0001-1872	91R81288MR04-A	4380 4 x 5 x 12	HOH	CLOSE	END	SYS-DED	CH-HDR	HO	HQ.	E I	i i	E I		0 1
		DB PACO	10-40127-1A0001-1872	91R81288MR04-B	4380 4 x 5 x 12	면	CLOSE	END	SYS-DED	CH-HDR	O.		E I		H !		10 1
20		DB TACO	CM4010: B2F950636		4380 5 x 4 x 10	£03	CLOSE	ENO.	SYS-DED	CH-HDH	E !	H 1	H !	H !	Д Н і	급	- C
	34008	DB TACO	CM4010 : B2F950636		4380 5 x 4 x 10	딸	CLOSE	END	SYS-DED	CH-HDH		II.	HO!	HO!	HO.	10	10
21		DO AERMTR, WNMN, MDLND	4L1-2	26720	8760 4 x 5 x 14A	띺	SPLIT	9	SYS-HDR	CH-HDR	H :	H I	HG :	CANT	CANT	CANT	CAN
	36000	DO AERMTR, WNMN, MDLND	4L1:4L1-410-2SC20	C79869	8760 4 x 5 x 14A	E :	SPLIT	99.	SYS-HDH	CHHON	ž	£ :	65.	S E	Z E	Z = 1	Z = 2
	36000	DO AURORA	411-BF	89-04044-3	8760 4 x 5 x 15	E :	SPEI	1 i	SYS-HDH	H H H	₹ 8	ž ;	ž	2 5	2 1	2 1	2 14
		30 WEINMAN	5L-1	731620-1	8760	¥ 5	SPLII	, E	SYS-HUH	CHHOH	8 9	9 5	2 4	CAR	CAN S	- F	
22		DE AURORA	411-BF	89-08589-2	8/60 BX BX 11B		12.0	ביים היים ביים			8 4	260	3 6	245	2 5	3 6	9 6
20		29 AURORA	341A-BF	75-7858	9360 2.5 X 3 X 3				SYS-HDB	CH-2/S	2 %	E G	S I	242	155	67	14.2
24		35014 AUTORA	411.RE	76-364-1	4380 4 x 5 x 15	HOH HOH	SPLIT	DBL	SYS-HDR	CH-HDR	75	848	170	929	191	73	43.2
ŭ		39015 AURORA	411-BF	76-364-2	4380 4 x 5 x 15	HOH	SPLIT	DBL	SYS-HDR	CH-HDR	22	848	170	929	191	73	43.2
98		39043 AURORA	411-BF		4380 4 x 5 x 10B	HOH	SPLIT	DBL	SYS-HDR	CH-HDR	78	953	200 200	22	234	8	53.7
ă		43 AUBORA	411-BF	92-11829	4380 4 x 5 x 10B	HOR	SPLIT	DBL	SYS-HDR	CH-HDR	78	953	200	22	234	80	53.7
72		03 DUNHAM-BUSH	B9TC-1	42612	4380 3		SPLIT	END			72	505	9	400	2	73	11.6
200		42000 DUNHAM-BUSH	B9C87-1	60462	4380 3	면	SPLIT	ENO			2	482	80	494	85	11	13.0
i X		O1 WEINMAN	3GB-2A: 3G-301-1GK-4-2BA-87	734990	8760 3×4×7	HÖH	SPLIT	END			23	325	11	270	8	75	7.3
30		AURORA	411-BF	90-12217-2	8760 2.5 x 3 x 10B	HOH	SPLIT	DBL	SYS-HDR	CH-1/M	8	208	75	290	22	75	7.1
		04 PACO	29-30957-120001	XE90E01830	8760	E :	SPLIT		SYS-HDR	CH-2E	8 8	508	75	167	88 7	67	9 0
	5000	50004 AURORA	411-BF	90-12217-1	8760 2.5 x 3 x 10B	HOH	SPLII	DEL.	SYS-HUH	CHEM	20 1	8	9	963	= !	4 5	5 6
31		87018 AURORA	411-BF	73-7738-1	4380 4 x 5 x 15	Ĕ :	SPLIT	9 E	SYS-HDH	CH-HOH	2 8	= ;	5 5	3 2	11	2 5	37.7
		87018 AURORA	411-BF	73-7738-2	4380 4 x 5 x 15	5 5	SPLE	L GRI	SYS-HUH	CH-HOY	7 %	34	2 9	213	CANT	CANT	CANT
35	-	91001 BELL & GOSSETT			4300	5	CLCCL				4	ţ	3	1			

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Table D-4. Chilled Water Pump Nameplate and Field Measurement Data

DSGN HA	_	480 3	208-220	208-220/440 3	208-230/460 3	208-230/460 3	208-220/440 3	e (9)	3 3 9	160 3	160	230/460 3	208-230/460 3	160 3	460 3	460	, teo	160	160 3	460 3	60	160	160	60	9 091	208-230/460 3	6	200-230/460 3	3 3 460	6	460 3	460 3	460	208-230/460 3	160 3	208-230/460 3	160 3	
DSGN DSGN DSGN POW SPD POT	-	10 1745 240/480	1800	1730	1750	1750	1735	20 1750 230/460	3520	.,	1760	15 1760 230/460	1725	1750	3480	3520	7.5 1755 230/460	1770		1760	25 1760 230/460	1760	1770	50 1770 230/460	1775	1140	1740	50 3535 200-230	1770	3550	3550	15 1765 230/460		1750	1750	1750	60 1775 230/460	
FRAME		2560	184JM 215YZ		213T	213T	2840	256T	256JP	256JP	254T	2541	215T	256T	215JM	215TY	2131	364TS	364TS	284JM	284JM	284JP	326T	3261 364T	365TS	256T	213JM	254JM	36415	364TS	364TS	254T	2151	213T	52137	213T	364TS	
SERIAL (CODE, ID, REF, SPEC) NO		9099		10F			55787	F-B045-00-045-KZ/1H0/3	R-6129-08-117-M	R-6129-08-117-M	39B01X50	39B01X50	F484	ೱ	B085/T01S326R048F	1 67 3000	B 705 (7=J) F-9237-06-168		BB-96583-74-14	E692AV06V119R163F	E692AV06V119H163F		2265774	2265776	2277820	R100649C911	64-01251-265			EN-ER4340		P25G5078A	780		24		AJ-96583-313-1	
MODEL (CAT, PRT) NO		319B314G89X	NVL18411UH/35/ANL W2556-2	SC-324U-FCAEM1-9-302205-01	NVN213TTDR7026GPL	NVN213TTDR7026GPL	XH284UT4R26BAW				M2513T	M2513T	M3714T	6-323411-01		5K215DN107	9-391021-60	6-321177-05	364TSTDS7026CB					5K264A1 205D2	SOCIAL	3N692		5K25470121 (7=3)	6-221177-05	364TSTDS7001EDW	6-320786-05		6-323403-02 M2314T	NVC213TTDR7026GPW	6-330771-03	NVC213TTDR7026GPW	364TSTDS7026CB	
PERF MFG CALC FLOW		WSTNGHS	STERLING ELECT	CENTURY	MARATHON	MARATHON	MARATHON	U.S. ELECT	U.S. ELECT	U.S. ELECT	BALDOR	BALDOR	BALDOR	CENTURY	U.S. ELECT	GEN ELECT	MAGNETEKVCENTUMY	GOULD	MARATHON	U.S. ELECT	U.S. ELECT	U.S. ELECT	LINCOLN	LINCOLN	LINCOLN	DAYTON	U.S. ELECT	GEN ELECT	GOULD	MARATHON	GOULD	RELIANCE	GOULD/CENIUMY	MARATHON	GOULD	MARATHON	MARATHON	
PERF CALC FLOW	GPM	!	143	4	240	262	1 8	6/5	825	825	430	395	325	745	į	435	20.00	830	760	570	650	610	I	1	1	902	1	500	1190	1060	1120	705	1	i	430		810	
PERF MEAS HEAD	F	9 5	8 8	118	8	28	,	2 8	3 4	74	99	9 6	2 8	69	8	7 3	5 G	159	166	97	¥ 5	97		1	1 1	27		116	122	178	165	69	2 1	0	89	55	160	
PERF P MEAS N LWP H	PSIG F	50.5	68.0	61.0	44.0	44.0	CANT	50.5	46.0	4.0	38.0	38.5	38.0	48.0	45.0	42.0	36.5	100.0	0.66	70.5	71.5	53.5	CANT -		1 1	86.5	OFF.	74.0	75.0	82.0	81.5		CAN		46.5	54.0	85.0	
PERF P	PSIG P	24.5	40.0	10.0	18.0	19.0	CANT	0.4.1 0.4.5	14.0	12.0	10.0	10.0	2.0	18.0	0.9	10.0	0.0	31.0	27.0	28.5	31.0	1.5	CANT		ָ ה ניי	75.0	P.	24.0	22.0	5.0	10.0	13.0	20.0		17.0	30.0	15.6	
DIA E	₫.						9.500 MOD				8.550 MOD			9.000 ACT			9.100 ACT				9.800 ACT											8.875 ACT			8.600 ACT			
SPD	RPM	1	1750	1750	1750	1750	1750	1750	3500	3500	1750	1750	1750	1750		3500	1750	1750	1750	1750	1750	1760	1750	1750	1750	1150	1750	3500	1750	3500	3500	1750	1/50	1750	1750	1750	1750	
DSGN D HEAD S			65	100	62	62	8 8	ខ្លួ	125	125	99	99	82	87		2 8	3 2	170	170	80	8 8	8 8	195	195	195	52	29	148	174	200	200	76	8 7	: &	8	80	170	
PSGN D	GPM FT		143	640	220	220	450	457	497	497	408	408	302	474		594	220	711	711	700	2,00	750	545	545	716	1015	260	328	949	953	953	506	325	212	212	212	711	
BLDG F	<u> </u>	121	135	194	410	410	2805	4 6 6	7050	7050	7051	7051	14023	21002	27004	27004	28000	29005	29005	31008	31008	34008	36000	36000	36000	36006	36009	36014	39015	39043	39043	41003	42000 50001	50004	50004	50004	87018	
L m Z		ļ.,	V	၈	2		0 1	- α	0		0	5	3 4	15	16	ŗ	_	18		19	ç	3	21			દ્ય	23	2 2	C	56		27	9 8	3 8	i		31	

APPENDIX D

Table D-4. Chilled Water Pump Nameplate and Field Measurement Data

PLANT		DSGN		NDSO L		DSGN	DSGN PERF		PERF	토	PERF NOIES
2	N S	r OS	FACT	r L		FACT		5 -	5 0	۳ ا	
									!	!	
		FLA	%	%		*	VOLT	AMP	AMP	AMP	
- 0	121	0 00 00	5 4	9 10	MEMA	4	8		416	41.2	DIMD ID _ 177716_B48
N	135	135 13.6-13.2/b.b	2	0.0	2	0.0	3	2			
(C)	19	65,0-61,0/30.5	1.15								
ı ko	410	410 21.6/10.8	1.15	84.0	MON	9.97					
		410 21.6/10.8	1.15	84.0	MOM	9.9/					
9	CI	2805 38.0/19.0	1.15				475	10.9	10.9	1.1	PUMP ID = 665030
7	5764	45.0	1.25	89.5	NEMA						SERVES 2nd AIR-COOLED CHILLER IN PARALLEL?
80	5792	54.0/27.0	1.15								HVAC PIPING IS CHANGEOVER W/ HTG & CLG PUMPS
o	7050	7050 62.4/31.2	1.15	86.5	NEMA						
		62.4/31.2	1.15	86.5	NEMA			13.8	13.8	12.5	
10			1.15	86.0	ď	81.0					
	7051		1.15	86.0	ᇿ	81.0					
13	14020	26.4-25.0/12.5	1.15	85.6		87.5					MOTOR CAT = R308
7		14023 28.0-26.0/13.0	1.00	87.0	로	82.0					MOTOR SPEC = 37A01250
15	21002	50.0/25.0	1.15								
9	27004	36.6/18.3	1.25								
	27004	38.4/19.2	1.15								
17			1.15	88.5	NEMA	87.0					MOTOR CAT = T345
	28000		1.15	85.5	NEMA						
6	29005	140.0/70.0	1.15								
		148.0/74.0	1.15	91.0	FACT	80.5		51.0	51.0	51.0	
19			1.15	89.2	FACT	83.0					DSGN EFF 89.5 NEMA (MTR)
	31008		1.15	89.2	FACT	83.0					DSGN EFF 89.5 NEMA (MTR)
20		34008 64.8/32.4	1.15	89.5	NEMA						
	34008	34008 64.8/32.4	1.15	89.5	NEMA						
2	36000	125.0/62.5	1.15	ш							
	36000	125.0/62.5	1.15	ш							REPLACED ONE GAUGE COCK
	36000	145.6/72.8	1.15	92.4	NEMA			PF.	님	HO H	
	36000	192.0/96.0	1.15	щ				PF.	H.	PF0	
8		31.5-30.0/15.0	1.15	82.5	NEMA	78.5			1		
ສ			1.15					94	ţ	ţ	CIRC PROVIDED TEMPORARILY BY 2 SECONDARY FUMPS W/ CROSSOVER VALVES CLOSED
24		54.7-49.6/24.8	1.15	88.5	NEMA						HPT LISTS BASE BID EQP BUT ALL BID EQP INSTALLED
52		140.0/70.0	1.15								
		39015 140.0/70.0	1.15	1		1					
56		92.0	1.15	91.0	FACT	85.5				9	NO PUMP NAMEPLATE
		39043 160.0/80.0	5.15	90.7		93.3		5	90.0	0.00	EWFUNT TAKEN AFTER STARINGS BLOWDOWN (CRUB DENT TOTAL)
27			1.15								IMP CONTRACTOR AND
88	•		15								COHRUGATED PIPE AT FOMP DISCHARGE
ස		50001 38.0-36.0/18.0	1.15	88.0	ፈ	95.0	460	6 6	4.0	10.5	MOTOR SPEC = 37B01X48
ဗ	50004	21.6/10.8	1.15	85.5		76.2					
	50004	21.0/10.5	1.15	82.9		80.7					PROPER IMP TRIM OF 8:35" YIELDS 370 GPM
	50004	21.6/10.8	1.15	85.5		76.2					
3		87018 146.0/73.0	1.15	91.0		80.5					
		87018 146.0/73.0	1.15	91.0	FACT	80.5					
S		04004120 4/40.2	-				470	S)	30	20	POMP NAMEPLA IE COMPONED, MOJOH HO

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Table D-5. Condenser Water Pump Nameplate and Field Measurement Data

The control of the	PICANT NO	PLANT BLDG NO	r IMFG	MODEL [CAT, SPEC] NO	SERIAL NO	EGP O YR S	OPER SIZE SCHED	ORIENT	ORIENT CPLNG SUCT	SUCT	FLOW CONFIG SUCT	FLOW CONFIG DISCH	EXIST vs vs 88/89	YA P	FLOW H	HEAD N	MEAS FLOW	PERF CALC HEAD
150						3	ava								Md	t	GPM	t
156		1	21 WEINMAN	4G20-2:4G-401-1-2GK-2P	735680-1		4380 4×5×7	HOH	CLOSE	END			4	88	909	55	602	18
159 PACO 10-4050-11001; 2011 200-11001; 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 2011 200-11001; 200-11001; 2011 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 200-11001; 2	.,•		35 WEINMAN	TLB	83397	26	4380 3	HOH	SPLIT	DBL	CT-1/N	CH-1/S	٠	Y Y	215	8	153	CANT
1400 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.140001 10.04957.14001 10.04		2	35 PACO	10-15505-110061-2611	92R82268MR01		4380 1.5 x 2 x 5		CLOSE	END	CT-2/S	CH-2N	Z	Z	ž	Z	Z	Z
410 ALUNDOA 411-5F 64-028-67-1 4-360 3-44 108 HOR SPLIT DBL CT-HD CH-HIN SAME 84 330 62 22 280 BLL4 ADOSETT 1510: 65192-48E-91/48F-FM 64-028-67-1 4-360 4-424 108 HOR SPLIT DBL CT-HD CH-HOR SAME 10 200 65 55 57 20 BLB CANNOR CREAT 1510: 65192-48E-91/48F-FM 64-028-67-1 COSSE TO THE CH-HOR SAME 10 1-30 10-30	.,	_	94 PACO	10-40957-140001	87ETR00624		4380 4 x 5 x 9.5	E E E	CLOSE	END	•		SAME	73	677	¥	485	79
411 ACT MINORA 411 ACT			10 AURORA	411-SF	84-02967-2		4380 3 x 4 x 10B	된	SPLIT	DBL	CT-HDR	CH-1/N	SAME	\$	330	62	333	62
512 big Delicity and		14	10 AURORA	411-SF	84-02967-1		4380 3×4× 10B	HOH	SPLIT	DBL	CT-HDR	CH-2/S	SAME	\$	330	83	324	8
STSP (MEINIAM) 1 1-01725-Queron-1-8622 (7-d.) 1 006864 6 14 06 14 6 14 72 1 1-01725-Queron-1-8622 (7-d.) 1 001726-Queron-1-8622 (7-d.)	_		35 BELL & GOSSETT	1510 : Q-51192-48B-91/8-BF-FM			4380 4×7×7	된	SPLIT	END			SAME	19	506	55	278	98
FORDING HIGH TABLE ALCO TABLE			S4 WEINMAN	ខា	106585	9	4380 4×5×8	HOR	SPLIT	DBL			~	8	535	¥	438	ន
Name Color	-		92 PACO	11-40125-046201-1852? (?=D)	GKN11251		4380 4 x 5 x 12	HOH	SPLIT	END			SAME	74	280	5	404	82
Name According		•	50 MUELLER	4G1P-200P12	031658	98	8760 4×5×7	HOH	CLOSE	END	CT-HDR	CH-HDR	SAME	87	480	72	674	92
14020 1402		70.	50 WEINMAN	4G20-2:4G-401-1-2GK-2P	735680-2	81	8760 4×5×7	된	CLOSE	GNS	CT-HDR	CH-HDR	SAME	85	480	72	737	63
Name	=		51 TACO	BB5008-7.00-C5B-2FL1	B7873Y	82	8760 5×8	된	SPLIT	END ON	CT-A/E	CH-A/S	SAME	82	28	88	284	83
14022 PACO 11-30956-732201 A 380 3.44.9 HOR SPLIT END P SPLI		705	51 TACO	BB5008-7.00-C5B-2FL1	B7873Y	. 88	0 5×8	된	SPLIT	END ON	CT-B/W	CH-B/N	SAME	82	200	28	512	35
4022 DAMAGN BLANCO 11-05055-732011 A2017030 (7-2) A300 34.4 %	÷		20 PACO	11-30955-733201	KX79547		4380 3×4×9	면	SPLIT	QN			SAME	86	421	45	340	81
21000 IDNI/HAMB-BISH BBTC-1 426519 426519 HOR SPLIT END SAME 71 1340 NA 21000 IDNI/HAMB-BISH BBTC-1 HOR SPLIT DBL CT-NP A-18 7 7 1340 NA 22000 IACO 29-503657-720061-A02-1 GTMF00447-A 4380 3x4.85 HOR SPLIT DBL CT-NP CH-NP C	-		23 PACO	11-30955-733201	ZAH17090 (?=2)		4380 3×4×9	E E	SPLIT	END			SAME	98	438	45	241	87
2700d PACO 29-50126-040001-1882 LHJ36148-A 4389 HOR SPLIT DBL T-H P 71 1340 NA 28000 PACO 29-30557-20061-A02-1 GTMF00A47-B 4380 4349.5 HOR SPLIT DBL CT-HDR CH-NR SAME 83 390 62 28000 PACO 29-30557-20061-A02-1 GTMF00A47-B 4380 5x8.11 HOR SPLIT DBL CT-HDR CH-NR SAME 83 390 62 28000 ALRIBAR 73-741-2 4380 5x8.11 HOR SPLIT DBL CT-HDR CH-NR SAME 83 390 62 38000 MERINARA 61.2 4390 5x8.11 HOR SPLIT DBL CT-HDR CH-NR 7 DF DF <t< td=""><td><i>=</i></td><td></td><td>02 DUNHAM-BUSH</td><td>B9TC-1</td><td>42619</td><td></td><td>4380 3</td><td>HOH</td><td>SPLIT</td><td>END</td><td>,</td><td></td><td>SAME</td><td>7.</td><td>624</td><td>33</td><td>503</td><td>26</td></t<>	<i>=</i>		02 DUNHAM-BUSH	B9TC-1	42619		4380 3	HOH	SPLIT	END	,		SAME	7.	624	33	503	26
2000 PACD 29-30557-720051-A02-1 GTMFO0447A 4380 3 x 4 s 8 b HOR SPLIT DBL CTHOR CH-HOR SAME 83 330 62 20000 ACOD	F		04 PACO	29-50126-040001-1882	LHJ36148-A		4380	면	SPLIT	DBL			~	74	1340	Ϋ́	779	8
29000 JACO 29-30957-200061-AGD-1 CTHOR CTHOR CTHOR CTHOR CHHOR SAME 89 330 62 29006 JALOCAA 411-8F 73-7741-2 4390 6x 8x 11 HOR SPLIT DBL CTHOR CHHOR SAME 87 1422 65 14 29006 JALOCAA 411-8F 73-7741-1 4390 6x 8x 12 HOR SPLIT DBL CTHOR CHHOR SAME 87 14 20 61 DF 17 17 14 <td>-</td> <td></td> <td>90 PACO</td> <td>29-30957-720061-A02-1</td> <td>GTMF00447-A</td> <td></td> <td>4380 3 x 4 x 9.5</td> <td>HOH</td> <td>SPLIT</td> <td>DBL</td> <td>CT-HDR</td> <td>CH-1/N</td> <td>SAME</td> <td>83</td> <td>330</td> <td>62</td> <td>252</td> <td>63</td>	-		90 PACO	29-30957-720061-A02-1	GTMF00447-A		4380 3 x 4 x 9.5	HOH	SPLIT	DBL	CT-HDR	CH-1/N	SAME	83	330	62	252	63
29006 AURORA 411-BF 73-7741-2 4380 6 x 8 x 11 HOR SPLIT DBL CTHOR CHHOR SAME 75 422 65 1 30065 AURORA 411-BF 73-7741-1 4380 6 x 8 x 11 HOR SPLIT DBL CTHOR CHHOR SAME 75 142 65 1 3008 AERNAR, WANN, MOLW 612: 612-400-38020 C76909 83 4390 6 x 8 x 12 HOR SPLIT DBL CTHOR CHHOR 7 N N DF		2800	00 PACO	29-30957-720061-A02-1	GTMF00447-B		4380 3 x 4 x 9.5	HOH	SPLIT	DBL	CT-HDR	CH-2/S	SAME	83	330	62	252	83
29005 AURORA 411-BF 73-774-1 4380 6 x 8 x 12 HOR SPLIT DBL CT+UDR CH+UDR SAME 75 4422 65 31008 FARMIR, WANNI, MDLND 6L2. 6L2-40C-39020 C75899 83 4380 6 x 8 x 12 HOR SPLIT DBL - SAME DF DF DIF 30000 FACO 22-50126-00000-1882 142633-3 64 8760 6 x 8 x 12 HOR SPLIT DBL - - AME DIF	=		05 AURORA	411-BF	73-7741-2		4380 6 x 8 x 11	된	SPLIT	DBL	CT-HDR	CH-HDR	SAME	75	1422	92	1132	11
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39043 AURORA 14 FL 1110, 15TG V83-72124 4380 VERT SPLIT SUMP CT-HDR SAME 78 1680 80 14 FL 1110, 15TG V83-72124 4380 VERT SPLIT SUMP CT-HDR SAME 78 1680 80 14 72 72 72 72 72 72 72 7	Ñ		43 AURORA	14 RL 1110, 1 STG	V85-70561		4380	VERT	SPLIT	SUMP	CT-HDR	CH-HDR	SAME	78	1680	80	1365	8
42618 4380 3 HOR SPLIT END SPLIT		3904	43 AURORA	14 RL 1110, 1 STG	V83-72124		4380	VERT	SPLIT	SUMP	CT-HDR	CH-HDR	SAME	78	1680	80	1365	8
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APPENDIX D

Table D-5. Condenser Water Pump Nameplate and Field Measurement Data

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SERIAL NO				R-6127-09-732-N	E658A/S04S0470017F	B069/T10T199R110F	B089/N06N100R164F			100112EH861	5910	9403610-3718821947	BOAR/NOSNOSOBOSOF	R-6127-10-157-M	F385	F385	BD9	F287	P21G5116ALU		F-9242-06-149	F-9242-05-149	230323	40D01X67	39D01X49		1/88C			10/80	454060	F1291		42B01W02	MW J1221253	DNJ413401	P21G5116ALU	38987251F4362		12	02100	100512	100610
MODEL NO								NVK215TTDB7026HTL	NVK215TTDB7026HTI	NVAC 131 ION OCCURE	LISCALZ				Maarit	M3311T	6-350057-40	M3714T		6-312794-01			BL286TTDR7026CDW	M2535T	M2515T	6-313037-05	M4104	1M326UTDR26CCWF2	1M326UTDR26CCWF2	M2539T	5E256TTFS7026AAW	JMM3212T	6-313482-02	M2539T	5K6253XL502A	5K6253XL502A			NVC215TTDR7026HTW	6-330772-02	80104DGF24A	BA286TTDR7026CDW	BA286TTDR7026CDW
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APPENDIX D

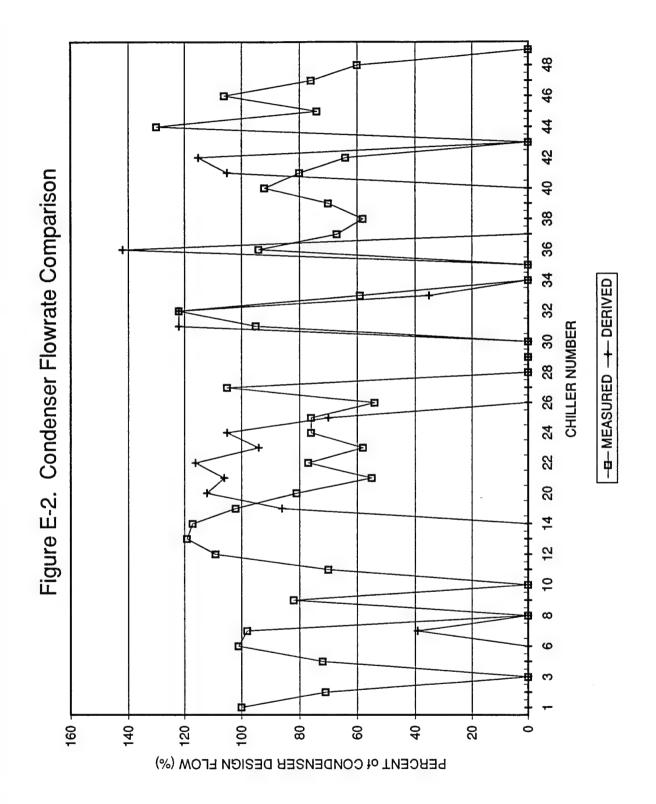
Table D-5. Condenser Water Pump Nameplate and Field Measurement Data

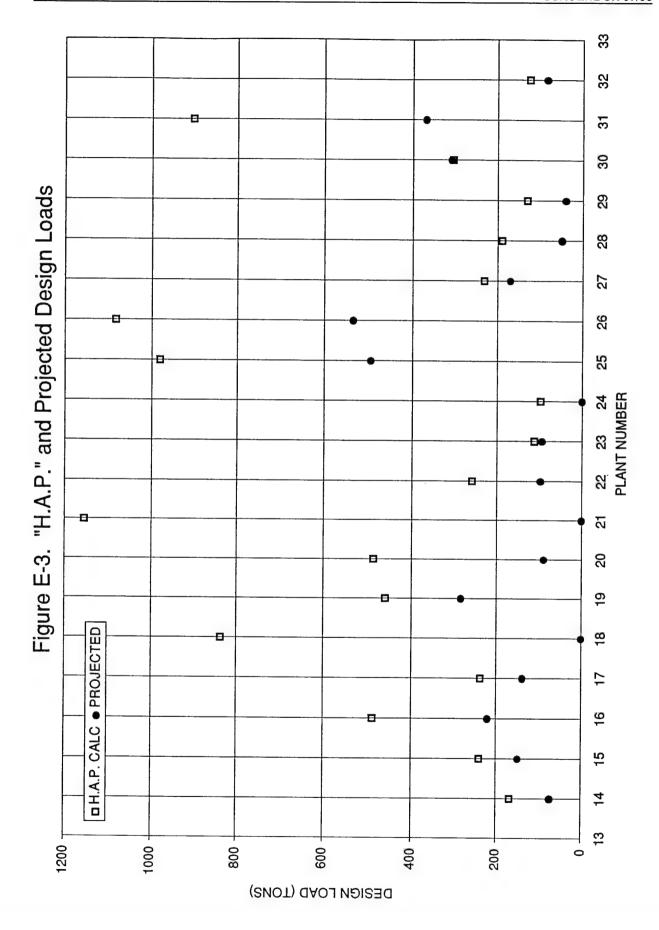
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Appendix E: Analysis of Field Measurement Data

Figure E-1. Evaporator Flowrate Comparison -a-MEASURED -+- DERIVED CHILLER NUMBER

PERCENT of EVAPORATOR DESIGN FLOW (%)





Appendix F: Derivation of Typical Cooling Load Profiles

The procedure outlined here was used to generate profiles of cooling load versus outside air temperature, and annual occurrence versus percent full load, for Building 39004, an enlisted men's barracks. These profiles were developed with simulated weather data for the months of May through October using the following procedures.

- 1. Reviewed and revised Carrier "Hourly Analysis Program" (HAP) version 1.10 input data furnished on floppy disk by USACERL, then converted data to version 2.01 format.
- 2. Ran Carrier HAP version 2.01 to obtain the maximum zone (building) cooling load, and cooling loads at 1-hour increments for 1 day in each of 6 cooling months.
- 3. Extracted month, time of day, outside air dry-bulb and wet-bulb temperatures, and cooling loads from HAP output, input same to Lotus "1-2-3" version 2.01 spreadsheet, then calculated percent-full-load at each 1-hour increment. See Table F1, HAP Cooling Load by Month and Time-of-Day.
- 4. Sorted data to obtain outside air temperatures in ascending order for each of three 8-hour time blocks (to correspond with published time/temperature/occurrence bin data).
- 5. Graphed percent full load versus outside air temperature, using Lotus "1-2-3" version 4.00 for each time block to determine shape of curves. Noted that each curve could be suitably represented by a linear equation. See Figure F1, HAP Cooling Load Versus Outside Air Temperature.
- 6. Input matrix of outside air temperature and percent full load for each time block into HP-48SX calculator, performed statistical analyses to obtain slopes and intercepts for "best-fit" linear equations, then calculated revised percent-full-load values in spreadsheet using linear equations. Noted that equations allowed extrapolation beyond outside air temperatures simulated by HAP.

Also noted that equations could be used to prorate measured chiller loads (at actual times and outside air temperatures) to design loads (at design conditions) to check sizing of chillers. See Table F2, Linear Approximation and Annual Occurrence of Cooling Load by Time Block and Outside Air Temperature, and Figure F2, Linear Approximation of Cooling Load versus Outside Air Temperature.

- 7. Input published hourly occurrences at 5-degree bins of outside air temperature for each time block into spreadsheet, then graphed annual occurrence versus percent full load. See "Mean Frequency of Occurrence of Dry Bulb Temperature...," an excerpt of published material included herein, and Figure F3, Annual Occurrence versus Percent Full Load (at 5-Degree Outside Air Temperature Bins).
- 8. Converted annual occurrence data from published 5-degree bins of outside air temperature to equivalent 10-percent bins of full load. Conversion involved interpolation of published hours to obtain hours at 10-percent full-load intervals, then multiplication of resultant hours by the ratio:

[Summation (% Full Load 5 °F * Annual Occurrence 5 °F)] [Summation (% Full Load 10% bins * Annual Occurrence 10% bins)]

to counteract the inflation of total hours caused by interpolation. See TableF3, Annual Occurrence of Cooling Load by Time Block and Percent Full Load(5% Bin), and Figure F4, Annual Occurrence versus Percent Full Load (at 10% Full Load Bins).

9. Repeated step 8 to obtain equivalent 5-percent bins of full load. Noted this bin increment would be more suitable than 10-percent bins for modeling multiple chiller plants. See Table F3, Annual Occurrence of Cooling Load by Time Block and Percent Full Load (5% Bin), and Figure F5, Annual Occurrence versus Percent Full Load (at 5% Full Load Bins).

APPENDIX F

Table F-1. H.A.P. Cooling Load by Month and Time-of-Day.

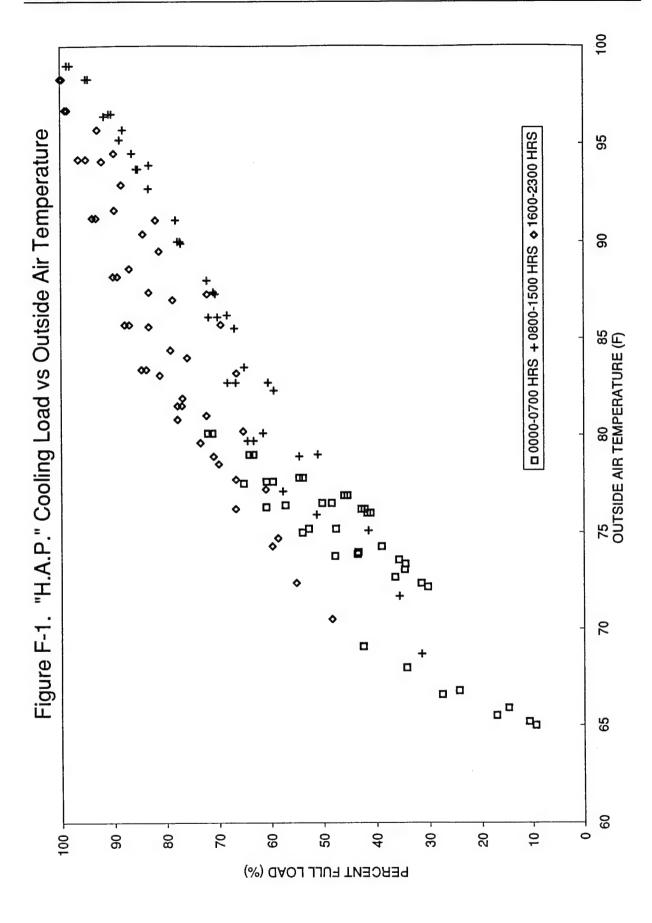
		TOUT !	LOAD	(%)	71.9	64.0	54.5	45.9	42.7	41.6	50.1	60.7	64.4	68.2	71.8	7.77	85.3	90.3	95.1	98.7	0	0.00	33.	9.96	94.0	90.1	87.9	84.7	77.8
	HAP	COOL	LOAD	(tons)	27.96	51.53	43.94	37.01	34.43	33.50	40.38	48.91	51.90	54.91	57.84	62.62	68.71	72.79	76.63	79.53	00 57	90.37	/9.88	77.86	75.71	72.59	70.85	68.21	65.69
	OA	WB	TEMP	Œ	72.0	71.7	71.4	71.1	70.9	70.8	71.0	71.3	71.9	72.7	73.7	74.7	75.7	76.4	76.8	77.0	7	70.0	4.0/	75.8	75.0	74.2	73.5	72.9	72.4
	OA	DB	TEMP	(F)	80.1	79.0	77.8	6.92	76.2	76.0	76.5	77.6	79.7	82.7	86.1	90.0	93.7	96.5	98.3	0.66	6	98.3	7.96	94.2	91.2	88.2	85.7	83.4	81.5
		time	ō	day	0	-	0	က	4	ည	9	/	œ	6	10	Ξ	12	13	14	15	(9 !	1	8	19	20	7	22	23
		_		اء	JUL	JUL	7	JUL.	JUL	7	킭	JUL	JUL	JUL	JUL	JOL	JUL	705	70,	JOL	=	J0F	7	7	705	JUL	JUL	JUL	JUL
		FULL	LOAD	(%)	65.1	57.1	47.5	38.9	35.7	34.5	43.4	53.9	57.6	61.4	65.0	70.9	78.1	83.2	88.2	91.7	0	93.0	92.2	89.8	87.0	83.3	81.2	77.8	70.9
	HAP	COOL	LOAD	(tons)	52.45	46.00	38.27	31.37	28.75	27.80	34.94	43.46	46.40	49.43	52.40	57.14	62.91	67.06	71.09	73.90		/4.89	74.26	72.39	70.13	62.09	65.41	62.67	57.16
	OA	WB	TEMP	(F)	70.2	6.69	69.5	69.3	69.1	69.0	69.1	69.5	70.1	70.9	71.9	73.0	74.0	74.7	75.2	75.4	1	75.2	74.8	74.1	73.3	72.5	71.8	71.1	9.02
	OA	DB	TEMP	(F)	77.5	76.4	75.2	74.3	73.6	73.4	73.9	75.0	77.1	80.1	83.5	87.4	91.1	93.9	95.7	96.4	1	95.7	94.1	91.6	88.6	85.6	83.1	80.8	78.9
		time	jo	day	0	-	0	က	4	2	9	7	œ	6	10	7	7	13	4	15		9	17	8	19	20	2	22	ន
				month	NOS	NOC	NOS	N N N	NOS	NOS	NOS	SCN	Z =	N	NON	SUN	NOC	NOS	NOS	NOS	:		S N	N	SON	SUN	SUN	NOC	S
		FULL	OAD	(%)	53.9	45.7	36.0	27.0	23.5	22.3	31.4	42.5	46.2	50.0	53.6	59.6	67.1	72.2	77.1	80.7		82.0	81.3	78.7	75.9	72.2	6.69	66.7	59.7
tons	HAP			(tons)	43.42	36.81	29.03	21.75	18.97	17.96	25.31	34.23	37.20	40.27	43.18	48.03	54.09	58.19	62.11	65.01		60.99	65.48	63.38	61.19	58.15	56.35	53.76	48.13
39004 80.57 to	OA	WB	<u> </u>	<u>(F.</u>	68.0							67.2		68.7	69.8	20.9	71.9	72.7	73.2	73.4		73.2	72.8	72.1	71.2	70.4	9 69	0.69	68.4
Building: ng Load:	OA	DB	۵	(F)	72.9	71.8	9.07	69.7	0.69	68.8	69.3	70.4	70 5	77.5	20.07	80.8	86.5	80.0	91.1	91.8		91.1	89.5	87.0	840	21.0	78.5	76.2	74.3
B. Soling		ime		_	0	-	2	(0)	4	Ŋ	9	7	α	0	,	2 =	. 0	1 (7	4	5		16	17	<u>∞</u>	φ	2 8	7 5	2	នេ
Building: Max Cooling Load:				month	1	MAY	MAY	MAY	MAY	MAY	MAY	MAY	>	> \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	MAY.	ΜAΥ	MAY	MAY	MAY		MAY	MAY	MAY	MAY	MAY	MAY.	MAY	MAY

APPENDIX F

Table F-1. H.A.P. Cooling Load by Month and Time-of-Day.

	₫
39004	80.57
Building:	lax Cooling Load:

		FULL	LOAD	(%)	42.4	34.2	24.3	14.6	10.6	9.3	17.0	27.5	31.4	35.6	41.4	51.0	60.4	6.99	70.5	72.1	1	72.1	09.5	66.5	65.2	6.09	58.6	55.1	48.3	
	HAP	COOL	LOAD	(tons)	34.13	27.52	19.55	11.75	8.58	7.53	13.69	22.12	25.31	28.67	33.39	41.12	48.63	53.88	56.77	58.11	6	28.08	20.02	53.59	52.52	49.05	47.20	44.38	38.88	
	OA	WB	TEMP	(F)	65.7	65.3	65.0	64.7	64.4	64.4	64.5	64.9	65.6	66.5	9.79	68.8	6.69	70.7	71.2	71.4	7	7 - 7	/0./	70.0	69.1	68.2	67.5	66.7	66.2	
	OA	DB	TEMP	(F)	69.1	68.0	8.99	62.9	65.2	65.0	65.5	9.99	68.7	71.7	75.1	79.0	82.7	85.5	87.3	88.0	1	07.70	85.7	83.2	80.2	77.2	74.7	72.4	70.5	
		time	o	day	0	-	0	က	4	2	9	7	æ	6	9	Ξ	12	13	4	15	,	1 9		8	9	8	7	22	23	
				month	OCT		- t	3	OCT	OCT	OCT	OCT	OCT	OCT																
		FULL	LOAD	(%)	8.09	52.7	43.3	34.6	31.4	30.2	36.4	47.7	51.2	54.5	59.3	68.3	77.1	83.3	86.5	88.8	0	0.00 0.00	88.5	84.4	83.3	79.1	76.8	73.4	9.99	
	HAP	COOL	LOAD	(tons)	48.98	42.48	34.87	27.85	25.26	24.36	29.35	38.46	41.26	43.92	47.78	55.03	62.12	67.14	69.72	71.56	1	74.77	71.28	67.97	67.08	63.75	61.88	59.11	53.63	
	OA	WB	TEMP	(F)	8.69	69.4	69.1	68.8	68.6	68.5	68.6	0.69	9.69	70.5	71.5	72.6	73.6	74.4	74.8	75.0	1	ν.4.α	74.4	73.7	72.9	72.1	71.4	70.7	70.2	
	OA	DB	TEMP	(F)	292	75.2	74.0	73.1	72.4	72.2	72.7	73.8	75.9	78.9	82.3	86.2	89.9	92.7	94.5	95.2		0.4.0 U. 0	92.9	90.4	87.4	84.4	81.9	9.62	77.7	
		time	o	day	0	-	2	က	4	2	9	7	8	6	10	Ξ	12	5	14	15	,	1 0	/	8	19	20	21	22	23	
				_							-	SEP	Ĺ	ט ה ה ה	N T	SEP	SEP	SEP	SEP	SEP	SEP									
		FULL	LOAD	(%)	71.1	63.2	53.8	45.3	42.1	41.0	48.3	59.5	63.2	9.99	70.1	77.2	85.6	8.06	94.7	98.2	1	99.7	98.7	95.2	93.3	89.3	87.0	83.8	6.92	
tons	HAP	COOL	LOAD	(tons)	57.30	50.92	43.37	36.46	33.92	33.03	38.94	47.96	50.89	53.64	56.47	62.23	68.94	73.13	76.29	79.16	0	30.30	79.53	76.73	75.18	71.95	70.13	67.48	61.98	
80.57	OA	WB	TEMP	(F)	72.0	71.7	71.4	71.1	70.9	70.8	71.0	71.3	71.9	72.7	73.7	74.7	75.7	76.4	76.8	77.0	1	10.0	4.07	75.8	75.0	74.2	73.5	72.9	72.4	
Max Cooling Load:	OA	08	TEMP	(F)	80.1	79.0	77.8	6.92	76.2	0.92	76.5	9.77	79.7	82.7	86.1	90.0	93.7	96.5	98.3	0.66	9	1 0	7.06	94.2	91.2	88.2	85.7	83.4	81.5	
oolin		time	ō	day	0	-	7	က	4	5	9	/	æ	6	9	Ξ	12	13	4	15	(1 0	>	18	19	20	5	22	33	
Max C				month	AUG	-	504	AUG	AUG	AUG	AUG	AUG	AUG	AUG																



APPENDIX F

Table F-2. Linear Approximation and Annual Occurance of Cooling Load

OA DB TEMP	OA DB TEMP		FULL LO	AD	ANNUA	OCCUF	RENCE		LL LOAD - OCCUR	
BIN		(BEST-F	IT LINEA	R EQN)	(5-DEG	BIN FOR	R 6 MO)			
Dire		00-07	08-15	16-23	00-07	08-15	16-23	00-07	08-15	16-23
F	F	%	%	%	HR/YR	HR/YR	HR/YR			
SLOPE	>>>	3.3	2.0	1.7				."		
INTERCE	PT >>>	-196.2	-104.5	-61.2						
	MP >>>	60.4	51.7	37.1						
100% TE		91.1	101.2	97.7						
35-39	37			-0.1	0	0	0			
40-44	42			8.1	4	0	0			0
45-49	47		-9.6	16.4	17	3	5			82
50-54	52		0.6	24.6	45	5	10		3	246
55-59	57	-11.0	10.7	32.9	88	11	32		118	1053
60-64	62	5.3	20.8	41.1	130	36	70	689	749	2877
65-69	67	21.5	30.9	49.4	237	77	121	5096	2379	5977
70-74	72	37.8	41.0	57.6	452	139	239	17086	5699	13766
75-79	77	54.0	51.1	65.9	399	217	292	21546	11089	19243
80-84	82	70.3	61.2	74.1	96	302	299	6749	18482	22156
85-89	87	86.5	71.3	82.4	5	317	215	433	22602	17716
90-94	92	102.8	81.4	90.6	0	251	133	0	20431	12050
95-99	97	119.0	91.5	98.9	0	97	50	0	8876	4945
100-104	102	135.3	101.6	107.1	0	17	8	0	1727	857
105-109	107	151.5	111.7	115.4	0	1	1	0	112	115
110-114	112	167.8	121.8	123.6	0	0	0	0	0	0
					1319	1470	1475	51597	92267	101083
					1473	1473	1475			
					AVG	%FL	>>	39.1	62.8	68.5
					AVG %F	L (6 MO)	>>			57.4
					EQUIV F	L HR/YR	>>	516	923	1011
				EC	QUIV FL H	IR/YR (6	MO) >>			2449

Figure F-2. Linear Approximation of Cooling Load vs Outside Air Temp

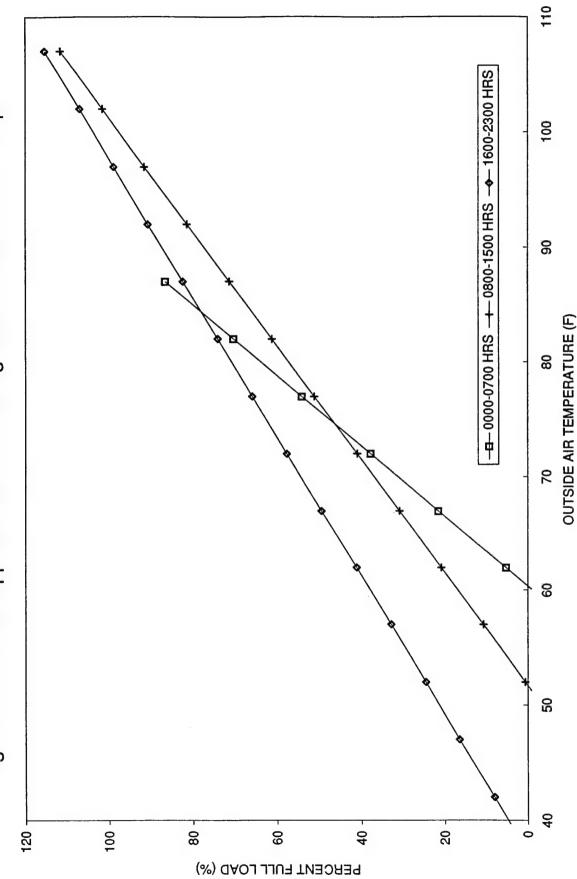
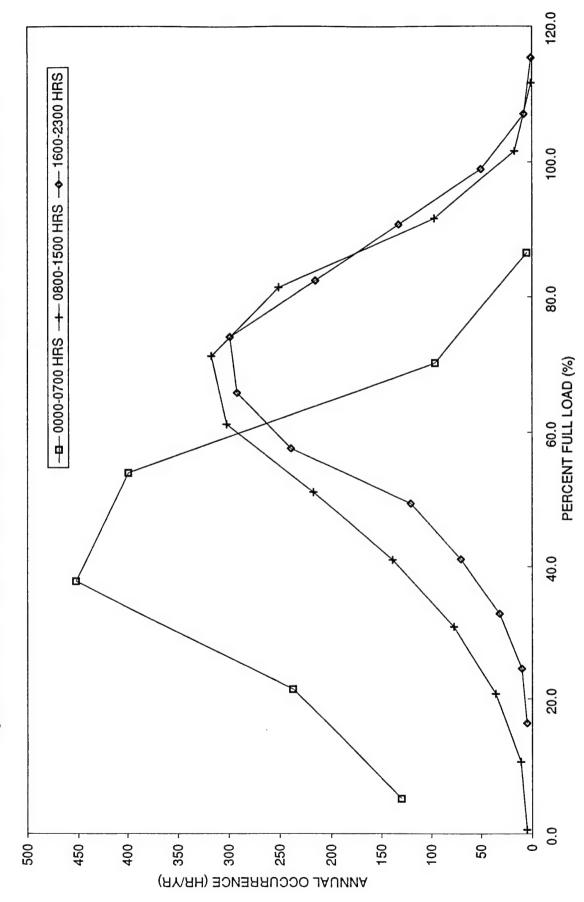


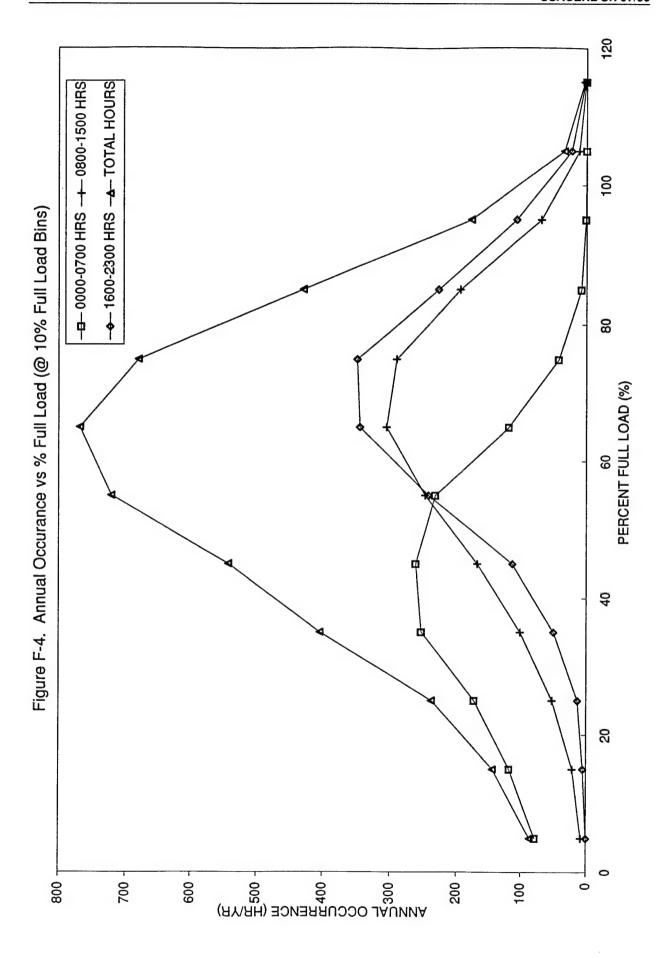
Figure F-3. Annual Occurance vs % Full Load (@ 5-deg. O.A.T. Bins)

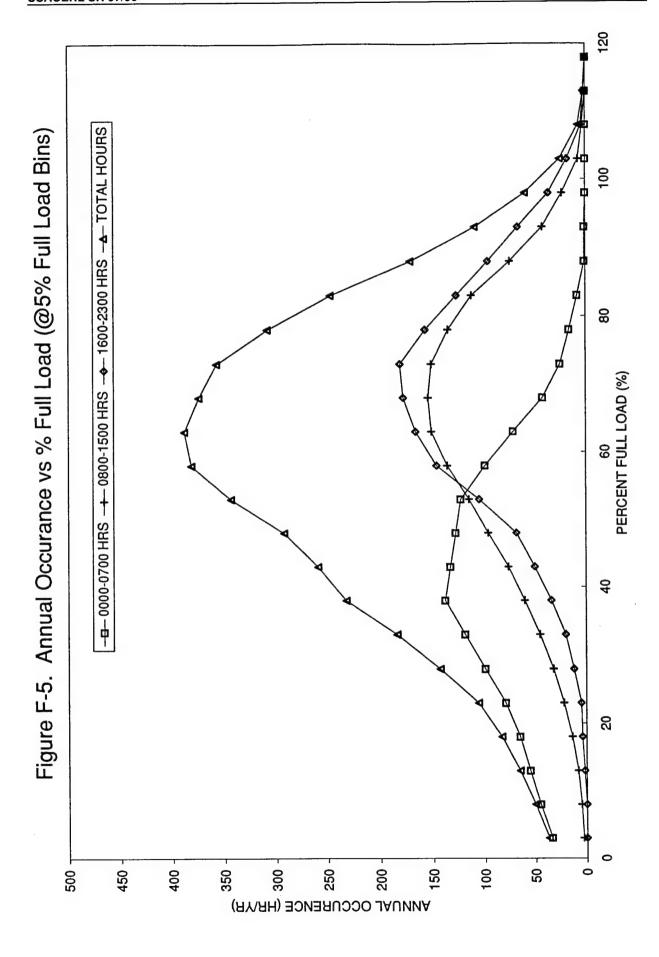


APPENDIX F

Table F-3. Annual Occurance of Cooling Load by Time Block & Percent full Load (5% bins)

% Full				
Load	00-07	Annual O 08-15	16-23	TOTAL
(5% bins)	00-07	equivalant		
3	34	3	0	37
8	45	5	0	50
13	55	8	2	65
18	65	14	4	83
23	79	22	5	106
28	99	32	12	143
33	119	45	20	184
38	138	60	34	232
43	133	76	50	259
48	128	96	68	292
53	123	115	105	343
58	99	136	146	381
63	71	151	166	388
68	42	154	178	374
73	25	151	181	357
73 78	16	135	157	308
83	8	112	127	247
88	1	74	96	171
93	1	42	66	109
98	o	23	36	59
103	0	7	18	25
103	0	3	4	7
113	0	0	2	2
118	0	0	0	0
110	1281	1464	1477	4222





Appendix G: Comparison of Alternate Types of Chillers and Cooling Towers

Table G-1. Comparison of Alternate Chiller Types by Installed Cost and Full Load Efficiency

ARI				Т	OTAL C	OST (\$)	UNIT	cos	Γ (\$/	TON)	conn	Efficie	ency
cap	Conp/Cond	Refrig	Model	mat'l	labor	equip	total		labor			load	(kW/	
tons												kW	full load	
104	recip-air	22	YCA	32815	9628	257	42700	315	92	2	410	131	1.260	NA
131	recip-air	22	YCA	39041	12306	744	52091	298	94	6	398	165	1.256	NA
161	recip-air	22	YCA	49482	14402	863	64747	308	90	5	403	199	1.236	NA
105	recip-wat	22	YCW	26022	8125	490	34637	248	77	5	330	90	0.854	NA
123	recip-wat	22	YCW	31546	9456	569	41571	258	77	5	339	106	0.861	NA
133	recip-wat	22	YCW	34342	9824	604	44770	258	74	5	337	109	0.822	NA
156	recip-wat	22	YCW	39752	10973	690	51415	254	70	4	329	127	0.813	NA
185	recip-wat	22	YCW	44493	12599	764	57856	240	68	4	312	157	0.848	NA
211	recip-wat	22	YCW	49649	14011	846	64506	235	66	4	305	178	0.842	NA
125	cent-wat	123	ΥT	51541	16058	0	67599	412	128	0	541	85	0.680	0.666
150	cent-wat	123	YT	53285	18917	0	72202	355	126	0	481	98	0.653	0.653
225	cent-wat	123	YT	59734	25441	0	85175	265	113	0	379	155	0.689	0.666
250	cent-wat	123	YT	61705	26599	0	88304	247	106	0	353	179	0.716	0.659
400	cent-wat	123	YT	92327	33544	0	125871	231	84	0	315	230	0.575	0.557
500	cent-wat	123	YT	100560	37587	0	138147	201	75	0	276	297	0.594	0.554
550	cent-wat	123	YT	106765		0	146374	194	72	0	266	339	0.616	0.562
600	cent-wat	123	ΥT	113633	41630	0	155263	189	69	0	259	365	0.608	0.566
600	cent-wat	22	YK	123421	41630	0	165051	206	69	0	275	373	0.622	0.634
400	screw-wat	22	YS	114668		0	148212	287	84	0	371	256		0.617
500	screw-wat	22	YS	100536		0	138123	201	75	0	276	310	0.620	0.583
600	screw-wat	22	YS	132295	41630	0	173925	220	69	0	290	367	0.612	0.570

APPENDIX G

Table G-2. Comparison of Alternate Chiller Types by Partial Load Efficiency

Conp-Cond	Refrig Model	Part	Part	%FL	%FL	DISPL	ECWT	OPT
		Load	Load	Cap	Power			STG
		Cap tons	Power kW	%	%	%	F	
CENT-WAT	GENERIC	toris	KAA	100	100	NA	85.0	NA
OLIVIPWAI	GENERIO			98	96	NA	84.5	NA
				93	89	NA	83.3	NA
				88	82	NA	82.0	NA
				83	76	NA	80.8	NA
				78	70	NA	79.5	NA
				73	64	NA	78.3	NA
				68	59	NA	77.0	NA
				63	54	NA	75.8	NA
				58	49	NA	74.5	NA
				53	44	NA	73.3	NA
				48	40	NA	72.0	NA
				43	36	NA	70.8	NA
				38	32	NA	69.5	NA
				33	28	NA	68.3	NA
				28	25	NA	67.0	NA
RECIP-WAT	22 YCW	105.1	89.8	100.0	100.0	100	85.0	
ILLOII WAY	22 1011	91.3	72.5	86.9	80.7	83	80.8	
		77.6	55.7	73.8	62.0	67	76.7	
		60.3	40.9	57.4	45.5	50	72.5	YES
		54.0	39.5	51.4	44.0	50	72.5	
		40.1	24.9	38.2	27.7	33	68.3	
		22.2	12.6	21.1	14.0	17	64.2	YES
RECIP-WAT	22 YCW	122.5	105.5	100.0	100.0	100	85.0	
RECIF-WAT	22 1000	106.0	85.0	86.5	80.6	83	80.8	
		89.8	65.1	73.3	61.7	67	76.7	
		69.7	47.7	56.9	45.2	50	72.5	YES
		63.3	46.3	51.7	43.9	50	72.5	0
		46.7	29.1	38.1	27.6	33	68.3	
		25.6	14.7	20.9	13.9	17	64.2	YES
RECIP-WAT	22 YCW	133.0	109.3	100.0	100.0	100	85.0	YES
HEOIR-WAT	22 1000	118.2	92.4	88.9	84.5	86	82.0	YES
		106.2	81.1	79.8	74.2	75	79.0	YES
		88.7	66.5	66.7	60.8	61	75.0	YES
		57.0	43.4	42.9	39.7	46	72.0	YES
		46.2	32.6	34.7	29.8	34	69.0	YES
		33.3	22.9	25.0	21.0	23	66.0	YES
		33.3	22.9	25.0	۷۱,0	20	00.0	IES

APPENDIX G

Table G-2. Comparison of Alternate Chiller Types by Partial Load Efficiency

Conp-Cond	Refrig Model	Part	Part	%FL	%FL	DISPL	ECWT	OPT
•	· ·	Load	Load	Cap	Power			STG
		Cap	Power	•				
		tons	kW	%	%	%	F	
RECIP-WAT	22 YCW	156.4	127.1	100.0	100.0	100	85.0	YES
		130.1	103.6	83.2	81.5	82	81.0	YES
		115.1	89.7	73.6	70.6	70	78.0	YES
		85.1	63.4	54.4	49.9	52	73.0	YES
		66.8	51.7	42.7	40.7	46	72.0	YES
		54.0	37.4	34.5	29.4	34	69.0	YES
		38.8	25.8	24.8	20.3	23	66.0	YES
RECIP-WAT	22 YCW	185.4	157.2	100.0	100.0	100	85.0	
		162.1	126.4	87.4	80.4	82	81.0	
		142.0	105.2	76.6	66.9	67	77.0	
		106.5	73.9	57.4	47.0	48	72.0	
		91.6	63.9	49.4	40.6	46	72.0	
		67.7	41.2	36.5	26.2	30	68.0	
		37.4	22.5	20.2	14.3	15	64.0	
RECIP-WAT	22 YCW	211.4	177.9	100.0	100.0	100	85.0	
		190.5	149.4	90.1	84.0	83	81.0	
		166.4	127.2	78.7	71.5	67	77.0	
		116.0	88.1	54.9	49.5	50	73.0	
		105.7	82.2	50.0	46.2	50	73.0	
		78.1	51.2	36.9	28.8	33	68.0	
		43.2	28.6	20.4	16.1	17	64.0	

Table G-3. Comparison of Alternate Chiller Types by Interpolated Partial Load Efficiency

TYPE	. 1	Cent-wat	Red	ciprocating	Compresso	r - Water C	ooled Cond	enser, R-22	2
FL CAP		GENERIC	AVERAGE	105.1	122.5	133.0	156.4	185.4	211.4
%Full L		0.2.,20	1					W. L. 7	
Capa				Per	cent Full Lo	ad Power			
0 4 5 4	•,								
BIN	BIN	(INTER)	(AVERAGE)	(INTER)	(INTER)	(INTER)	(INTER)	(INTER)	(INTER)
05%	10%	%	%	`%	%	%	%	%	%
28		25	21	20	20	24	23	20	22
30		26	23	21	21	26	25	22	24
33		28	26	24	24	28	28	24	26
38	3	32	30	28	28	34	34	28	30
43	3	36	36	34	33	40	41	33	37
48	3	40	42	40	39	44	45	39	44
53	3	44	46	44	44	49	49	43	48
58	3	49	50	46	46	53	54	48	52
63	3	54	55	51	51	58	59	53	57
68	3	59	60	56	56	62	65	58	62
73	3	64	65	61	61	67	70	63	66
78	3	70	71	68	68	72	76	69	71
83	3	76	77	75	76	78	81	75	76
88	3	82	83	82	83	83	87	81	82
93	3	89	90	90	90	90	92	89	89
98	3	96	97	97	97	97	98	97	97
100)	100	100	100	100	100	100	100	100
					0.4	00	05	00	04
	30	26	23	21	21	26	25	22	24
	35		27	25	25	31	31	25	28
	45		39	36	36	42	43	36	40
	55		48	45	45	50	51	45	50
	65		57	53	53	59	61	55	59
	75		67	64	64	69	72	65	68
	85		79	78	79	80	84	78	78
	95		93	93	93	93	95	92	92
	100	100	100	100	100	100	100	100	100

Table G-4. Payback Comparison of Reciprocating vs. Centrifugal Water Cooled Chillers

FL L ap in 0%	bao	Annual Occur (equiv)	%FL Power		PL Effic	Power	Energy	%FL	PL	power	Energy
in			Power		Effic		A				
		(equiv)					Consum	Power	Effic		Consum
Λº/-			1								
U /0		TOTAL					Option 1				Option 2
6 t	ons	hr/yr	%		kW/ton	kW	kWh/yr	%	kW/ton	kW	kWh/yr
				WAT					/AΤ		
			R-22								
				/ton							
			10					10			
	125					106.3				85.0	
	38	310	23		0.000	0.0			0.000		0
	41	184	26		0.000	0.0		1	0.000	0.0	0
	48	232	30		0.000	0.0			0.000	0.0	0
	54	259	36		0.000	0.0	0	36	0.000	0.0	0
	60	292	42		0.000	0.0	0	40	0.000	0.0	0
	66	343	46		0.000	0.0	0	44	0.000	0.0	0
	73	381	50		0.000	0.0	0	49	0.000	0.0	0
	79	388	55		0.000	0.0	0	54	0.000	0.0	0
	85	374	60		0.000	0.0	0	59	0.000	0.0	0
	91	357	65		0.000	0.0	0	64	0.000	0.0	0
	98	308	71		0.000	0.0	0	70	0.000	0.0	0
	104	247	77		0.000	0.0	0	76	0.000	0.0	0
	110	171	83		0.000	0.0	0	82	0.000	0.0	0
	116	109	90		0.000	0.0	0	89	0.000	0.0	0
	123	59	97		0.000	0.0	0	96	0.000	0.0	0
	125	34	100		0.000	0.0	0	100	0.000	0.0	0
30 - (EQ)	38	285	23		0.196	7.4	2109	26	0.178	6.7	1910
35	44	404	27		0.233	10.2	4121	30	0.201	8.8	3555
45	56	542	39		0.328	18.5	10027	38	0.256	14.4	7805
55	69	721	48		0.405	27.9	20116	46	0.313	21.5	15502
65	81	768	57		0.483	39.3	30182	56	0.381	31.0	23808
75	94	680	67		0.571	53.6	36448	66	0.452	42.4	28832
85	106	429	79		0.674	71.6	30716	78	0.533	56.7	24324
95	119	177	93		0.789	93.7	16585	92	0.624	74.1	13116
100 >(ACT)	125	37	100		0.850	106.3	3933	100	0.680	85.0	3145
,							154237	1			121997
	\$0.024	/kWh	•				\$3,702	/yr			\$2,928 /YF
	\$152.60	/kW-yr					\$16,214	/yr			\$12,971 /YF
							\$19,916	/yr			\$15,899 /YF
							\$42,375				\$67,625
	30 - (EQ) 35 45 56 75 85	125 38 41 48 54 60 66 73 79 85 91 98 104 110 116 123 125 30 - (EQ) 38 35 44 45 56 55 69 65 81 75 94 85 106 95 119 100 >(ACT) 125	125 38 310 41 184 48 232 54 259 60 292 66 343 73 381 79 388 85 374 91 357 98 308 104 247 110 171 116 109 123 59 125 34 30 - (EQ) 38 285 35 44 404 45 56 542 55 69 721 65 81 768 75 94 680 85 106 429 95 119 177	RECIP-I R-22 \$339 10 125 38 310 23 41 184 26 48 232 30 54 259 36 60 292 42 66 343 46 73 381 50 79 388 55 85 374 60 91 357 65 98 308 71 104 247 77 110 171 83 116 109 90 123 59 97 125 34 100 30 -(EQ) 38 285 23 35 44 404 27 45 56 542 39 35 44 404 27 45 56 542 39 55 69 721 48 65 81 768 57 75 94 680 67 85 106 429 79 95 119 177 93 100 >(ACT) 125 37 100	RECIP-WAT R-22 \$339 /ton 10 125 38 310 23 41 184 26 48 232 30 54 259 36 60 292 42 66 343 46 73 381 50 79 388 55 85 374 60 91 357 65 98 308 71 104 247 77 110 171 83 116 109 90 123 59 97 125 34 100 30 -(EQ) 38 285 23 35 44 404 27 45 56 542 39 55 69 721 48 65 81 768 57 75 94 680 67 85 106 429 79 95 119 177 93 100 >(ACT) 125 37 100	RECIP-WAT R-22 \$339 /ton 10 125 38 310 23 0.000 41 184 26 0.000 48 232 30 0.000 54 259 36 0.000 60 292 42 0.000 66 343 46 0.000 73 381 50 0.000 79 388 55 0.000 85 374 60 0.000 91 357 65 0.000 91 357 65 0.000 91 357 65 0.000 104 247 77 0.000 104 247 77 0.000 110 171 83 0.000 110 171 83 0.000 110 171 83 0.000 110 171 83 0.000 110 171 83 0.000 1123 59 97 0.000 123 59 97 0.000 125 34 100 0.000 30 -{EQ} 38 285 23 0.196 35 44 404 27 0.233 45 56 542 39 0.328 55 69 721 48 0.405 65 81 768 57 0.483 75 94 680 67 0.571 95 119 177 93 0.789 100 >(ACT) 125 37 100 0.850	RECIP-WAT R-22 \$339 /ton 10 125 106.3 38 310 23 0.000 0.0 41 184 26 0.000 0.0 48 232 30 0.000 0.0 54 259 36 0.000 0.0 60 292 42 0.000 0.0 66 343 46 0.000 0.0 73 381 50 0.000 0.0 79 388 55 0.000 0.0 79 388 55 0.000 0.0 91 357 65 0.000 0.0 91 357 65 0.000 0.0 98 308 71 0.000 0.0 98 308 71 0.000 0.0 104 247 77 0.000 0.0 104 247 77 0.000 0.0 110 171 83 0.000 0.0 110 171 83 0.000 0.0 110 171 83 0.000 0.0 30 -{EQ} 38 285 23 0.196 7.4 35 44 404 27 0.233 10.2 45 56 542 39 0.328 18.5 55 69 721 48 0.405 27.9 65 81 768 57 0.483 39.3 75 94 680 67 0.571 53.6 85 106 429 79 0.674 71.6 95 119 177 93 0.789 93.7 100 >(ACT) 125 37 100 0.850 106.3	RECIP-WAT R-22 \$339 /ton 10 125 106.3 38 310 23 0.000 0.0 0.0 41 184 26 0.000 0.0 0.0 48 232 30 0.000 0.0 0.0 60 292 42 0.000 0.0 0.0 66 343 46 0.000 0.0 0.0 73 381 50 0.000 0.0 0.0 79 388 55 0.000 0.0 0.0 79 388 55 0.000 0.0 0.0 85 374 60 0.000 0.0 0.0 98 308 71 0.000 0.0 0.0 98 308 71 0.000 0.0 0.0 98 308 71 0.000 0.0 0.0 104 247 77 0.000 0.0 0.0 110 171 83 0.000 0.0 0.0 110 171 83 0.000 0.0 0.0 116 109 90 0.000 0.0 0.0 123 59 97 0.000 0.0 0.0 30 -(EQ) 38 285 23 0.196 7.4 2109 35 44 404 27 0.233 10.2 4121 45 56 542 39 0.328 18.5 10027 55 69 721 48 0.405 27.9 20116 65 81 768 57 0.483 39.3 30182 75 94 680 67 0.571 53.6 36448 85 106 429 79 0.674 71.6 30716 85 106 429 79 0.674 71.6 30716 85 106 429 79 0.674 71.6 30716 95 119 177 93 0.789 93.7 16585 100 >(ACT) 125 37 100 0.850 106.3 3933 154237	RECIP-WAT R-22 \$339 /ton 10 125 106.3 106.3 1184	RECIP-WAT R-22 \$339 /ton 10 10 10 10 10 10 10 10 10 10 10 10 10	RECIP-WAT R-22 \$339 Aton 100 \$541 Aton 10 \$10 \$125 \$106.3 \$85.0 \$106.3 \$85.0 \$106.3 \$85.0 \$106.3 \$85.0 \$106.3 \$85.0 \$106.3 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10 \$10

Table G-4. Payback Comparison of Reciprocating vs. Centrifugal Water Cooled Chillers

TX	FIX	OUT	F	1X	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT
FL	%FL	Load	A	nnual	%FL	PL	Power	Energy	%FL	PL	power	Energy
apacity	Cap		(Docur	Power	Effic		Consum	Power	Effic		Consum
in	bin		(equiv)								
5%	10%		7	TOTAL				Option 1				Option 2
6	%	tons	ł	nr/yr	%	kW/ton	kW	kWh/yr	%	kW/ton	kW	kWh/yr
	/pe:				RECIP-WAT				CENT-	WAT		
	frig:				R-22				R-123			
Installed C	•				\$318 /ton				\$447	/ton		
bin (5/10					10				1	0		
FL Valu	ues:		175				148.8				119.0	
30 - (E0	2)		38	310	23	0.000	0.0	C	1			0
33			41	184	26	0.000	0.0	(1			0
38			48	232	30	0.000	0.0	(0
43			54	259	36	0.000	0.0	(1			0
48			60	292	42	0.000	0.0	(1			0
53			66	343	46	0.000	0.0	(1			0
58			73	381	50	0.000	0.0		1			0
63			79	388	55	0.000	0.0		1			0
68			85	374	1	0.000	0.0		1			0
73			91	357		0.000	0.0		6			0
78			98	308		0.000	0.0		7			0
83			104	247	ł.	0.000	0.0		7			0
88			110	17	1	0.000			8			0
93			116	109		0.000			8 0			
98			123	5	-	0.000			1	6 0.000		
100 >(A	CT)		125	3	i	0.000			0 10			
	30 -(EQ)	38	28	1	0.196				6 0.178		
	35		44	40	1	0.233				0 0.20°		
	45		56	54	4	0.328						
	55		69	72	1	0.405			1			
	65		81	76		0.483			1	6 0.38 6 0.45		
	75		94	68	t	0.571				8 0.53		
	85		106	42	1	0.674				2 0.62		
	95		119	17		0.789			1			
	100 >(ACT)	125	3	7 100	0.850	106.3	15423	-	0.00	00.0	121997
			0.024	/k/M/h				\$3,70				\$2,928 /
energy				/kW-yr				\$22,69	•			\$18,159 /
demand	cost:	Φ	132.00	/KTT-y1					•			****
power	cost:							\$26,40	1 /yr			\$21,087 /
installed	cost:							\$55,65	0			\$78,225

diff install cost: \$22,575 diff power cost: (\$5,314) /YR

simple payback: 4.2 yr (w/o Utility Rebate)

Table G-4. Payback Comparison of Reciprocating vs. Centrifugal Water Cooled Chillers

FIX	FIX	OUT	FIX	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT
%FL	%FL	Load	Annual	%FL	PL	Power	Energy	%FL	PL	power	Energy
Capacity	Cap		Occur	Power	Effic		Consum	Power	Effic		Consum
bin	bin		(viupe)								
05%	10%		TOTAL	-			Option 1				Option 2
%	%	tons	hr/yr	%	kW/ton	kW	kWh/yr	%	kW/ton	kW	kWh/yr
Туре				RECIP-WAT				CENT-W	VAT		
Refrig	:			R-22				R-123			
Installed Cost	:			\$308 /ton				\$413	/ton		
bin (5/10 ?)	:			10				10)		
FL Values	:	200				170.0				136.0	
30 - (EQ)		38		23	0.000	0.0	0	26	0.000	0.0	0
33		41		1	0.000	0.0	0	28	0.000	0.0	0
38		48		1	0.000	0.0	0	32	0.000	0.0	0
43		54		1	0.000	0.0	0	36	0.000	0.0	0
48		60		i .	0.000	0.0	0	40	0.000	0.0	0
53		66		1	0.000	0.0	0	44	0.000	0.0	0
58		73			0.000	0.0	0	49	0.000	0.0	ō
63		79	388		0.000	0.0	0	54	0.000	0.0	0
68		85	374	60	0.000	0.0	0	59	0.000	0.0	0
73		91	357	65	0.000	0.0	0	64	0.000	0.0	0
78		98	308	71	0.000	0.0	0	70	0.000	0.0	0
83		104	247	77	0.000	0.0	0	76	0.000	0.0	0
88		110	171	83	0.000	0.0	0	82	0.000	0.0	0
93		116	109	90	0.000	0.0	0	89	0.000	0.0	0
98		123	59	97	0.000	0.0	0	96	0.000	0.0	0
100 >(ACT)		125	34	100	0.000	0.0	0	100	0.000	0.0	0
	30 - (EQ)	38	285	23	0.196	7.4	2109	26	0.178	6.7	1910
	35	44	404	27	0.233	10.2	4121	30	0.201	8.8	3555
	45	56	542	39	0.328	18.5	10027	38	0.256	14.4	7805
	55	69	721	48	0.405	27.9	20116	46	0.313	21.5	15502
	65	81	768	57	0.483	39.3	30182	56	0.381	31.0	23808
	75	94	680	67	0.571	53.6	36448	66	0.452	42.4	28832
	85	106	429	1	0.674	71.6	30716	78.	0.533	56.7	24324
	95	119		93	0.789	93.7	16585	92	0.624	74.1	13116
	100 >(ACT)	125	37	100	0.850	106.3	3933	100	0.680	85.0	3145
							154237				121997
energy cost:		\$0.024					\$3,702				\$2,928 /YR
demand cost:		\$152.60	/kW-yr				\$25,942	/yr			\$20,754 /YR
power cost:							\$29,644	/yr			\$23,682 /YR
installed cost:							\$61,600				\$82,600
OPT 2 vs OPT 1							· · · · · · ·				
	diff install cost:	\$21,000									
	diff power cost:	(\$5,962)	/YR								
	mple payback:			Jtility Rebate)							

APPENDIX G

Table G-5. Comparison of Alternate Cooling Tower Types by Installed Cost and Connected Load

IN						MEANIS	MEANIC							
TOWER TYPE MODEL MTL LAB EQP TOT UNIT UNIT UNIT TOTAL UNIT CAP @ COST COST COST COST COST COST COST COST		Z	Z	Z		OUT			OUT	OUT	OUT	OUT	OUT	OUT
CAP @ COST COST COST COST MTL LAB EQP TOT CONN COST LOAD LOST COST COST COST COST COST COST COST C	1	TOWER	TYPE	MODEL		LAB	EQP		LINI	UNIT	LINO	TINO	TOTAL	LINO
95F EWT 85F LWT 77F WB MBH MBH MBH MBH MBH MBH MBH MBH MBH MB		CAP @				COST	COST		MTL	LAB	EQP	TOT	CONN	CONN
## ADJSTD ### ### ### ### ### ################	رن	35F EWT						Ū	COST	COST	COST	COST	LOAD	LOAD
77F WB \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	w	35F LWT												
## \$\\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$ \\$		77F WB				ADJSTD							(
0 1365 OPEN, AXIAL ICT-4-59 5363 619 5982 59 7 0 66 2.98 8 1827 OPEN, AXIAL ICT-4-612 6444 705 7170 50 6 0 59 4.47 2 1938 OPEN, AXIAL ICT-4-612 6444 726 7170 50 6 0 59 4.47 0 2310 OPEN, AXIAL ICT-4-612 7467 852 8319 48 6 0 54 7.46 0 2490 OPEN, AXIAL ICT-4-912 7599 916 8515 46 6 0 54 7.46 0 2490 OPEN, AXIAL AT-8-59B 10734 1316 12050 45 5 0 50 7.46 0 3600 OPEN, AXIAL ATW-91G 22779 705 23484 187 6 0 18.64 1938 CLOSED, AXIAL ATW-916		MBH				ઝ	↔	€	\$/ton	\$/ton	\$/ton	\$/ton	κW	kW/ton
1827 OPEN, AXIAL ICT-4-612 6444 705 7149 53 6 0 59 4.47 1938 OPEN, AXIAL ICT-4-612 6444 726 7170 50 6 0 55 4.47 2310 OPEN, AXIAL ICT-4-812 7467 852 8319 48 6 0 54 7.46 2490 OPEN, AXIAL ICT-4-912 7599 916 8515 46 6 0 54 7.46 2490 OPEN, AXIAL AT-8-59B 1960 1105 10065 45 5 0 50 7.46 3600 OPEN, AXIAL AT-8-99B 10734 1316 12050 45 5 0 50 7.46 3600 OPEN, AXIAL ATW-91C 22779 705 23484 187 6 0 18.47 1938 CLOSED, AXIAL ATW-135B 32931 916 33867 199 6 0 <td< td=""><td>0</td><td>1365</td><td>OPEN, AXIAL</td><td>ICT-4-59</td><td>5363</td><td>619</td><td></td><td>5982</td><td>29</td><td>7</td><td>0</td><td>99</td><td>2.98</td><td>0.03</td></td<>	0	1365	OPEN, AXIAL	ICT-4-59	5363	619		5982	29	7	0	99	2.98	0.03
1938 OPEN, AXIAL ICT-4-612 6444 726 7170 50 6 0 55 4.47 2310 OPEN, AXIAL ICT-4-812 7467 852 8319 48 6 0 54 7.46 2490 OPEN, AXIAL ICT-4-912 7599 916 8515 46 6 0 51 7.46 3015 OPEN, AXIAL AT-8-59B 10734 1316 12050 45 5 0 50 7.46 3015 OPEN, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1365 CLOSED, AXIAL ATW-91C 22779 726 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 1938 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	- α	1827	OPEN, AXIAL	ICT-4-612	6444	705		7149	23	9	0	29	4.47	0.04
2310 OPEN, AXIAL ICT-4-812 7467 852 8319 48 6 0 54 7.46 2490 OPEN, AXIAL ICT-4-912 7599 916 8515 46 6 0 51 7.46 3015 OPEN, AXIAL AT-8-59B 8960 1105 10065 45 5 0 50 7.46 3600 OPEN, AXIAL AT-8-99B 10734 1316 12050 45 5 0 50 7.46 1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1827 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135B 32951 916 3852 28845 18 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 33396 1105 6 0	2	1938	OPEN, AXIAL	ICT-4-612	6444	726		7170	20	9	0	22	4.47	0.03
2490 OPEN, AXIAL ICT-4-912 7599 916 8515 46 6 0 51 7.46 3015 OPEN, AXIAL AT-8-59B 8960 1105 10065 45 5 0 50 7.46 3600 OPEN, AXIAL AT-8-59B 10734 1316 12050 45 5 0 50 7.46 1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1387 CLOSED, AXIAL ATW-91C 22779 705 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 18.64 2490 CLOSED, AXIAL ATW-207A 42546 1316 33867 199 6 <td< td=""><td>i c</td><td>2310</td><td>OPEN, AXIAL</td><td>ICT-4-812</td><td>7467</td><td>852</td><td></td><td>8319</td><td>48</td><td>9</td><td>0</td><td>54</td><td>7.46</td><td>0.05</td></td<>	i c	2310	OPEN, AXIAL	ICT-4-812	7467	852		8319	48	9	0	54	7.46	0.05
3600 OPEN, AXIAL AT-8-59B 8960 1105 10065 45 5 0 50 7.46 3600 OPEN, AXIAL AT-8-99B 10734 1316 12050 45 5 0 50 14.91 1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1827 CLOSED, AXIAL ATW-91C 22779 705 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	0	2490	OPEN, AXIAL	ICT-4-912	7599	916		8515	46	9	0	51	7.46	0.04
3600 OPEN, AXIAL AT-8-99B 10734 1316 12050 45 5 0 50 14.91 1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1827 CLOSED, AXIAL ATW-91C 22779 726 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96		3015	OPEN. AXIAL	AT-8-59B	8960	1105		10065	45	5	0	20	7.46	0.04
1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 206 12.68 1827 CLOSED, AXIAL ATW-91C 22779 705 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-1358 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	. 0	3600	OPEN, AXIAL	AT-8-99B	10734	1316		12050	45	ß	0	20	14.91	90.0
1365 CLOSED, AXIAL ATW-68C 18084 619 18703 199 7 0 200 12.00 17.15 1827 CLOSED, AXIAL ATW-91C 22779 705 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96						0		7070	Ş	1	c	900	02 07	,
1827 CLOSED, AXIAL ATW-91C 22779 705 23484 187 6 0 193 17.15 1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	0	1365	CLOSED, AXIAL	ATW-68C	18084	619		18/03	25	,	>	202	7.00	<u>†</u>
1938 CLOSED, AXIAL ATW-91C 22779 726 23505 176 6 0 182 17.15 2310 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	ω	1827	CLOSED, AXIAL	ATW-91C	22779	705		23484	187	9	0	193	17.15	0.14
2310 CLOSED, AXIAL ATW-135A 27993 852 28845 182 6 0 187 18.64 2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	Ŋ	1938	CLOSED, AXIAL	ATW-91C	22779	726		23505	176	ဖ	0	182	17.15	0.13
2490 CLOSED, AXIAL ATW-135B 32951 916 33867 199 6 0 204 18.64 3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED, AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	0	2310	CLOSED, AXIAL	ATW-135A	27993	852		28845	182	9	0	187	18.64	0.12
3015 CLOSED, AXIAL ATW-135B 33396 1105 34501 166 5 0 172 26.10 3600 CLOSED AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	0	2490	CLOSED, AXIAL	ATW-135B	32951	916		33867	199	9	0	204	18.64	0.11
3600 CLOSED AXIAL ATW-207A 42546 1316 43862 177 5 0 183 27.96	0	3015	CLOSED, AXIAL	ATW-135B	33396	1105		34501	166	Ŋ	0	172	26.10	0.13
	0	3600	CLOSED, AXIAL	ATW-207A	42546	1316		43862	177	2	0	183	27.96	0.12

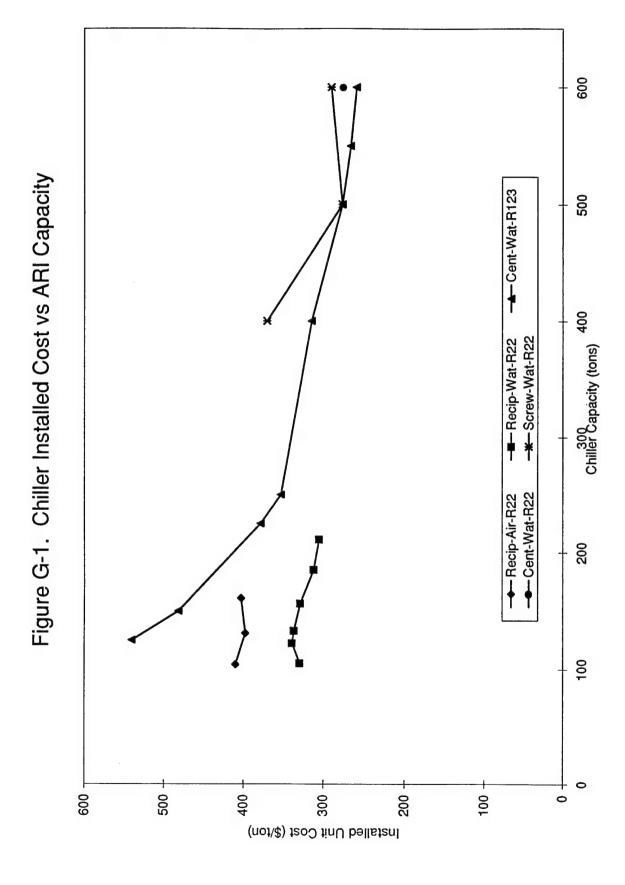
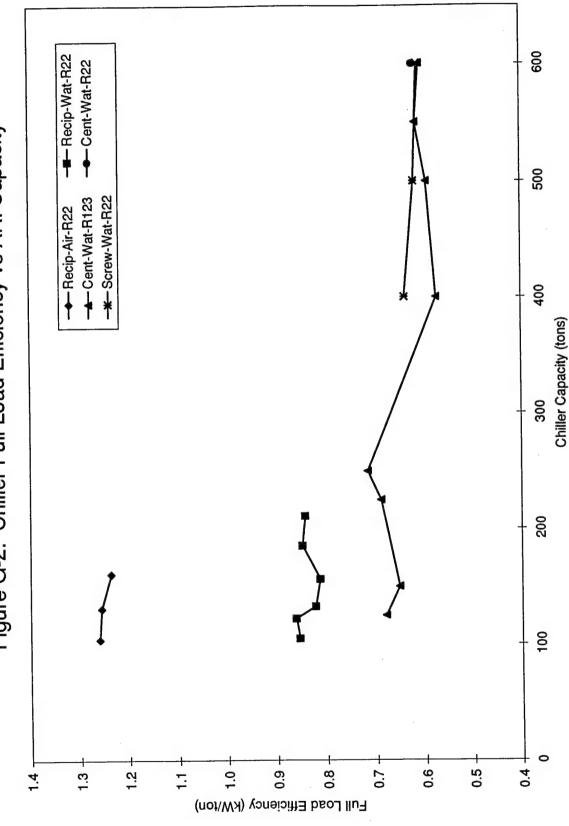
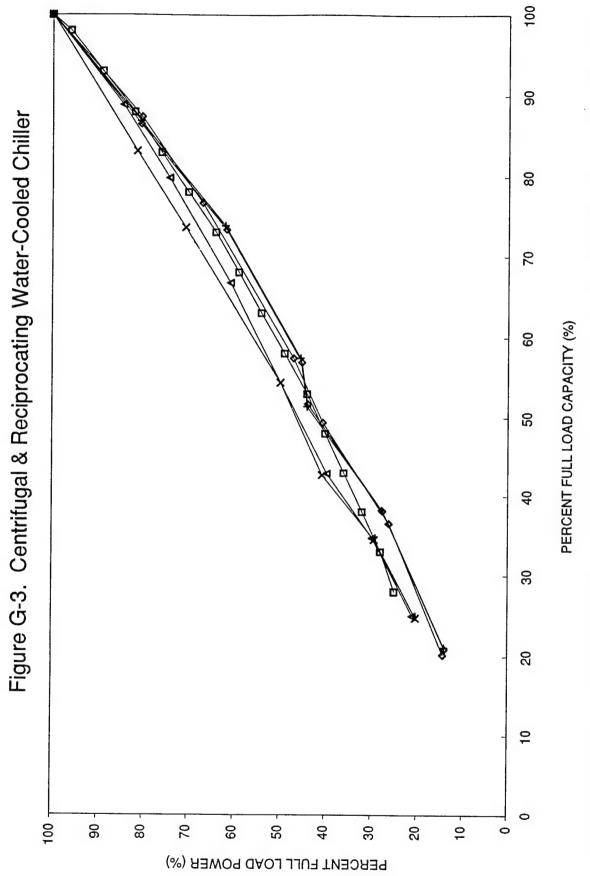


Figure G-2. Chiller Full Load Efficiency vs ARI Capacity





-B-CENT - GENERIC -+- RECIP-105 TONS -+- RECIP-123 TONS -A- RECIP-133 TONS -X- RECIP-156 TONS -+- RECIP 185 TONS

Appendix H: Algorithms and Data for

Calculation of Chiller Energy

Cost

APPENDIX H

Table H-1. Algorithyms and Data for Calculation of Chiller Energy Cost

REPTO PARTY WATER WATER WATER WATER COORDING SEASON	% RAT CAP	RAT POW	% RAT POW	% RAT POW		(d	ACTORY S.	"""" PROCEDURE FOR DEVELORING MODEL FOR TURBO-MODULATOR """" (FACTORY SIMULATION TEMPORARILY UNAVAILABLE)	MODELF. RARILY UN	OR TURE AVAILAB	SO-MODUL SLE)	ATOR					
UNI		RECIP		CENT/URBO WAT			ADJUST w/ UNEAR		COMP 6 MON	ARE PER TH COOL	FORMANC ING SEAS	SE FOR					
STATE STAT		RECIP	SCREW	SCREW/TURBO WAT			CHANGE			SE S	KW'HR	KW*HR					
10	88 4 8 8 8 8 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	99.28.4.20.2.20.0	-				<u>.</u>			È	2	S					
1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,	£ # 5			-01		0.0				104	0.00						
\$15 0.330	8 8	12				2.2			332		83.0						
11.1 0.460 222 222 116.8 70.1 11.1 0.460 322 222 116.8 70.1 12.2 0.560 331 343 16.5 133.4 12.5 0.560 331 341 16.5 133.4 12.5 0.560 331 341 16.5 133.4 12.5 0.720 37.4 37.4 220.7 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 1813 2.5 0.720 27.2 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720 27.2 27.2 27.2 27.2 2.5 0.720	3 3 8	3 8				9. Q. 6. Q.			184		51.5						
11 0.350 24.2 29.2 2	43	8 6				8.0			259		83.2						
195 0.550 381 381 186.7 133.4	23	44				14.9			343		150.9						
State Stat	80 6	ກີເ				19.5			381		186.7						
10 10 10 10 10 10 10 10	8 8 6	8 8				31.4			374		220.7						
ST2 0.780 ST3 0.780 ST3 0.780 ST3 0.780 ST3 0.780 ST3 0.820 TT1 TT1 1402 ST3 0.820 TT1 TT1 1402 ST3 0.820 TT1 TT1 1402 ST3 0.820 ST4 0.8	5 K	7 65				38.9			357		228.5						
1410 1402 1402 1402	83					57.2			247		187.7						
String S	8 6	80 6				68.1			171		140.2						
100.0 0.830 34 34 34.0 38.7 21 % SAVED >: 2146.1 1693.8 21	9 00	6 6				94.1			800		56.6						
21 % SAVED >: 2146.1 1699.8 (S1'Mi.1)) El'O1.1, ØROUND(S1'Mi.1)) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S21 Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S1'Wi.1) S1'Wi.1) S1'Wi.1) S21 % SAVED >: 2146.1 1699.8 S1'Wi.1) S1'Wi.1) S22 Wi.1) S23 Wi.1) S24 % SAVED >: 2146.1 1699.8 S1'Wi.1) S25 Wi.1) S25 Wi.1) S26 SAVED >: 2146.1 1699.8 S1'Wi.1) S27 Wi.1) S27 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S29 Wi.1) S29 Wi.1) S20 EQ-3-1 S20 EQ-3-1 S20 EQ-3-1 S20 EQ-3-1 S21 Wi.1) S21 Wi.1) S21 Wi.1) S21 Wi.1) S22 Wi.1) S23 Wi.1) S23 Wi.1) S24 Wi.1) S25 Wi.1) S26 SAVED >: 2146.1 1699.8 S27 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S28 Wi.1) S29 Wi.1) S20 EQ-3-1 S20 EQ-3-1 S20 EQ-3-1 S20 EQ-3-1 S20 EQ-3-1 S21 Wi.1) S21 Wi.	100	100	_			100.0			34		34.0	36.					
[\$(1'Mi,1)] E1'Q1,1),@ROUND(S1'Mi,1)] B1'MI),(AT1'ANI,0) BROUND(S1'Mi,1)] BROUND(AT1'ANI,1)] C'MI'ANI),@ROUND(AT1'ANI,1)] C'MI'ANI),@ROUND(AT1'ANI,1)] C'MI'ANI),@ROUND(AT1'ANI,1)] C'MI'ANI),@ROUND(AT1'ANI,1)] C'MI'ANI,BROUND(AT1'ANI,1)] C'MI'ANI,BROUND(ATI'ANI,1)] C'MI'ANI,BROU									21	% SAVED	>: 2146.1						
SI'M1) GROUND(SI'M1,1)	EQ-1-1		ØIF(E1<				1			-							
STYMIN (ATTYMIN ORDOUND(ET MIT (MITANIN) 1) ORDOUND(STYMIN 1)	EQ-21-1 EQ-21-2		ØIF(E1%	Q1 <s1*m1,@round(e1*q1 (1-Q1)<at1*an1,@round(e< td=""><td>1,1),@ROUND(S1'M1,1)) E1'(1-Q1),1),@ROUND(AT1</td><td>.AN1,1))</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></at1*an1,@round(e<></s1*m1,@round(e1*q1 	1,1),@ROUND(S1'M1,1)) E1'(1-Q1),1),@ROUND(AT1	.AN1,1))											
### PROUND(STML1) ####################################	EQ-2M-1		ØIF(E1<	Q1'M1,+E1,@IF(E1<(S1'M1))+(AT1*AN1),@ROUND(E1*	-M1/(M1+A	.N1),1),@R(JUND(\$1*M1,1)))									
Vidi 'ANI),@ROUND(E1'S1'MI/U1.1),@IF(E1-W1,@ROUND(E1'S1'MI/W1.1),@ROUND(AT1'ANI.1)) Vidi 'ANI),### PROUND(E1'AT1'ANI.U1.1),@IF(E1-W1,@ROUND(E1'AT1'ANI.U1.1)) Vidi 'ANI),####################################	EQ:25:1		ØIF(E1-) ØIF(E1<	AVI <s1'm1,+e1-av1,@rou< td=""><td>ND(S1'M1,1))</td><td>AN1,1),@</td><td>IF(E1<(Q1*)</td><td>MI)+((ARI+ATI)/2*A</td><td>NI),@ROL</td><td>IND((AR1</td><td>+AT1)2'AI</td><td>N1,1).</td><td>OUND(AT1*AN1,1))))</td><td></td><td></td><td></td><td></td></s1'm1,+e1-av1,@rou<>	ND(S1'M1,1))	AN1,1),@	IF(E1<(Q1*)	MI)+((ARI+ATI)/2*A	NI),@ROL	IND((AR1	+AT1)2'AI	N1,1).	OUND(AT1*AN1,1))))				
Y AA AC AE AG AI AK AX AZ BB BD BF BH BQ BS BU BY 0.0 EQ:21:1 0.0 EQ:21:1 0.0 EQ:21:2 0.0 EQ:21:2<	EQ-3-1 EQ-3-2 EQ-3-3 EQ-3-8		@IF(E1< @IF(E1< @IF(E1>) (S1'M1)+	.01'M1,4E1,@IF(E1<01'(M1') .01'M1,40,@IF(E1<01'(M1') Y1-AV1<001,40,@IF(E1-Y1- .(AT1'AN1) .(AT1'AN1)+(B01'BK1)	I'ANI),@ROUND(EI'SI'M' ANI),@ROUND(EI'ATI'AN AVI'EBOI'BKI,+EI-YI AVI	1/UI,1),© 11/UI,1),@ 1,@ROUNI	F(E1 <w1,g IF(E1<w1,e D(BO1*BK1,</w1,e </w1,g 	PROUND(E1'S1'M1. PROUND(E1'AT1'A (1)))	W1,1),@R	OUND(S1	(((((,1)))) (AT1*AN1,1	(((()					
0.0 EQ-1-1 0.0 EQ-21-1 0.0 EQ-28-1 0.0 EQ-28-1 0.0 EQ-38-2 0.0 EQ-38-2 0.0 EQ-38-2 0.0 EQ-38-2 0.0 EQ-38-2 0.0 EQ-38-2 0.0 EQ-38-2			5	- X	W AC				1	1	ł	BF	BB	1	1	BY	5
1526 \$KAWYR 0.034 \$KWHR	CHILE 2 CHILE 2 CHILE 2 CHILE 3 CHILE	RS-IEA	CLATION EPENDEN D/LAG ST D MODUL D/LAG ST	T MODULATION AGED MODULATION ATION / LAG 3-STEP AGED MODULATION	0.0 EQ-21-1 0.0 EQ-21-1 0.0 EQ-2M-1 0.0 EQ-2S-1 0.0 EQ-3-1				0.0 EQ-21- 0.0 EQ-2M 0.0 EQ-25- 0.0 EQ-3-2	233			0.0 EC	9-9-9			
	DEMAND	CHARGE	61.01	152.6 \$/KW"YR 0.024 \$/KW"HR										1			

APPENDIX H

*	W/ TURBO	%	# TONS # K.W #DIV/0I KW/TON	POWEHANNUAL POWEHANNUAL OCCUR ENERGY ADJUST CONSUMP	HRYR KWHYR	000			000			00												0		0
;;	××¢×	×	Q.	OWEHANN OCC ADJ	KW HR	0.0	0.0	0.0	0 0	0.0	0.0	0.0	0.0	0.0	0.0	9 6	0.0	0.0	0.0	0.0	000	0.0	0.0	0.0	0.0	1
MASTER CHILLER NO (LAG 2)			;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	RAT Pow	%	* *:	* *	*	* 1	* #	*	####	####	***	####	****	####	####	****	****	****	****	****	****	* ***	
A CHILLER	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	% % RAT RAT CAP CAP ACT ADJ	% %		**** ****			**** ****			## ####				****				****	* * ***			* ****	
MASTE	COMPRESSOF CONDENSER: REFRIGERANI STATUS:	CONFIGURA LOAD LIMIT:	RATED RATED RATED	CHIL	TONS				_						_											
	W/ TURBO		TONS KW KW/TON	NNUAL NERGY ONSUMP	KWHWR	0	0 0	0	0	00	0	0	0 0	0	0	0 (0 0		0	0	9 6	0	0	0	0	•
*	×× ±×	** **	* TONS * X W * NOT/WA IO/VIO#	POWERANNUAL OCCUR ENERGY ADJUST CONSUMP	HRYR K	0	00	0	0	0 0		0												0		
.AG 1):				POWER W	ΚM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9 6	0.0	0.0	0.0	9 6	0.0	0.0	0.0	9 6	000	0.0	* 0.0	
MASTER CHILLER NO (LAG 1):	SSOR: SER: RANT:	CONFIGURATION: MIN LAG SETPOINT: LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	% % % RAT RAT RAT CAP CAP POW ACT ADJ	% % %	#### ####	**** ****	#### ####	#### ####	****	****	*### ####	#### ####	**** ****	#### ####	#### ####	**** ****	**** ****	**** ****			**** ****			****	
MASTER	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: MIN LAG SETPOIN LOAD LIMIT:	RATED CAPACIT RATED POWER: RATED EFFICIEN	CHIL	TONS	*								-											*	
*	W/TURBO	 %% **	# TONS # KW #DIV/0I KW/TON	POWERANNUAL ANNUAL OCCUR ENERGY ADJUST CONSUMP	HRYR KWHYR	0 0		000				0														
(O):	××¢×	X RATE L	IQ#	POWERANI OO AD,	KW HR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1
R NO (LEAD)		N: PT or PRO-RATE L	: چن خ	" RAT	%	* ***	***	***	****	***	***	****	####	***	####	****	***	****	***	####	***	****	****	****	* ****	
MASTER CHILLER	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: MAX LEAD SETPT LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	% RAT CAP ACT	% % S	### #### #	# ####	* ***	* ***	# ####	* ***	* ****	####	####	* * * * * * * * * * * * * * * * * * * *				***					****		
MAS	COMPRE CONDEN	MAX	RATE	CHIC	TONS	-							- <u>-</u>	_				_			_	_	_			
	# TONS # %DSGN		MR //TON'YR	PLANT	Χ×	00		0.0			0.0				0.0									0 0	, o	
PI ANT NO:	****	0.0	0\$ 0\$	ANNUAL OCCUR ACTUAL	HRYR	4380	37	25 5	83	106	143	484	259	292	343	388	374	357	308	171	109	59	∾ี ′	•		***************************************
)EL:		SI.	PLANT LOAD SHED	TONS	00			0.0		0.0				0.0		0.0			0.0	0				000	
ON CA	BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL:	PEAK DEMAND: CONSUMPTION:	ENERGY COST: TOTAL COST:	PLANT	TONS	V.	s o	S	S 000	າທ	s	S 0.0	ດທ	S	S 0.0	n u	າທ	S 0.0	S	so u	8 00	S	S	000	0.0	s o
PI ANT NO	BUILDING NO: DESIGN LOAD WINTER LOAD SIMULATION M	PEAK	ENERGY COST: TOTAL COST:	% PLANT DSGN	. %		e	80	5 5	23 -	28	88	8 4	48	53	8 8	2 8	73	78	88	88	86	103	108	113	

```
MACRO "A" COPIES APPROPRIATE EQUATIONS TO CALCULATE CHILLER LOAD BASED UPON SPECIFIED SIMU
            START PROCESSING, AFTER "HIDING" UNNECESSARY COLUMNS, W/ CURRENT (HIGHLIGHTED) CELL ON PLA
     A
            /RNCPLANTADD~~
            (DOWN 4)
            {LET EQUATION,@CELLPOINTER("CONTENTS")}~
            (RIGHT 2){END}{RIGHT}{END}{RIGHT}{DOWN 18}
            (IF EQUATION="EQ-1"){BRANCH EQ-1}
            (IF EQUATION="EQ-21")(BRANCH EQ-21)
            (IF EQUATION="EQ-2M")(BRANCH EQ-2M)
            (IF EQUATION="EQ-2S")(BRANCH EQ-2S)
            (IF EQUATION="EQ-3")(BRANCH EQ-3)
            /RNDPLANTADD~
            {BLANK EQUATION}~
            (QUIT)
   EQ-1
           /CEQ-1-1~.{END}{DOWN}~/RU.{END}{DOWN}~
            {GOTO}PLANTADD~
            /RNDPLANTADD~
           {BLANK EQUATION}~
           {QUIT}
   EQ-21
           /CEQ-2I-1~.{END}{DOWN}~/RU.{END}{DOWN}~
           {RIGHT 15}
           /CEQ-2I-2~.(END){DOWN}~/RU.(END){DOWN}~
           {GOTO}PLANTADD~
           /RNDPLANTADD~
           {BLANK EQUATION}~
           (QUIT)
           \label{eq:ceq2M-1} $$ \CEQ-2M-1^{.}END}{DOWN}^{RU.}END}{DOWN}^{-}
   EQ-2M
           {RIGHT 15}
           CEQ-2M-2~.(END){DOWN}~/RU.{END}{DOWN}~
           {GOTO}PLANTADD~
           /RNDPLANTADD~
           {BLANK EQUATION}~
           (QUIT)
   EQ-2S
           /CEQ-2S-1~.{END}{DOWN}~/RU.{END}{DOWN}~
           {RIGHT 15}
           /CEQ-2S-2~.(END){DOWN}~/RU.{END}{DOWN}~
           {GOTO}PLANTADD~
           /RNDPLANTADD~
           (BLANK EQUATION)~
           {QUIT}
   EQ-3
           /CEQ-3-1~{LEFT 4}.{END}{DOWN}~/RU.{END}{DOWN}~
           {RIGHT 15}
           /CEQ-3-2~.{END}{DOWN}~/RU.{END}{DOWN}~
           {RIGHT 15}
           /CEQ-3-3~.{END}{DOWN}~/RU.{END}{DOWN}~
           (GOTO)PLANTADD~
           /RNDPLANTADD~
           {BLANK EQUATION}~
           (QUIT)
EQUATION
PLANTADD
```

```
MACRO "B" CALCULATES % RATED POWER FROM % RATED (ADJUSTED) CAPACITY.
RERUN MACRO IF CHILLER CAPACITY OR LOAD IS CHANGED FOR ANY REASON.
                   RERUN MACRO IF CHILLER CAPACITY OR LOAD IS CHANGED FOR ANY RÉASON.
START PROCESSINS W. CURRENT (HIGHUGHTED) CELL ON MASTER CHILLER NUMBER.
(DOWN 2/RIGHT 2)
(LET TYPE, @CELLPOINTER("ADDRESS"))-
(IF @EXACT(@@(TYPE), "W. TURBO")/(LET OFFSET,6)-(LEFT 2/(BRANCH SET)
(LEFT 2)
(LET TYPE, @CELLPOINTER("ADDRESS"))-
(IF @EXACT(@@(TYPE), "RECIP")/(LET OFFSET,2)-(BRANCH SET)
(IF @EXACT(@@(TYPE), "CENTY)/(LET OFFSET,4)-(BRANCH SET)
(IF @EXACT(@@(TYPE), "SCREW")/(LET OFFSET,4)-(BRANCH SET)
(BRANCH ABORT)
                   (DOWN 20)(LEFT 6)
(LET PASS,1)-
(LET %FLPREV,0)-
(BRANCH START)
     SET
                   (IF @CELLPOINTER("CONTENTS")=0){RIGHT 2}0-{LEFT 2}{DOWN}\BRANCH START} {LET %FL_@CELLPOINTER("CONTENTS")}--{BRANCH TEST}
   START
                   (RIGHT 2)
/RNCPOWADD-
                   MANGFOWADD--

(IF PASS=1){GOTO)TABLE-{BRANCH ROUTE}
(IF %FL-%FLPREV;(LET PASS,1)-{LET %FLPREV,0}-{GOTO)TABLE-/RNDPREVADD-{BRANCH ROUTE}
(GOTO)PREVADD-
                    RNDPREVADD-
                    (BRANCH ROUTE)
                   {IF %FL=@CELLPOINTER("CONTENTS")}{BRANCH COPY}
   POLITE
                   /RNCPREVADO-
   COPY
                   (LET PASS,2)-
(RIGHT OFFSET)
                   (LET %FLPOW,@CELLPOINTER(*CONTENTS*))~
(BRANCH CONTINUE)
                   (IF %FL>@CELLPOINTER("CONTENTS"));DOWN)(BRANCH INTER)
{LET %FLHI.@CELLPOINTER("CONTENTS")}-
{RIGHT OFFSET}
   INTER
                    (LET %FLPOWHI,@CELLPOINTER("CONTENTS")}-
                   (UP)
(LET %FLPOWLO,@CELLPOINTER("CONTENTS"))~
                   (LET OFFSET)
{LET %FLLO,@CELLPOINTER("CONTENTS")}~
RNCPREVADD--
                   INTO-FREVADU--
(LET PASS, 2}-
{LET %FLPOW,@ROUND(%FLPOWLO+((%FL-%FLLO)(%FLHI-%FLLO)*(%FLPOWHI-%FLPOWLO)),0)}-
{BRANCH CONTINUE}
CONTINUE {GOTO}POWADD-
/RV%FLPOW---
{LET %FLPREY, %FL}-
{BLANK VARIABLES}-
/RNDPOWADD-
                    {BRANCH TEST}
                    (DOWNVLEFT 2)
    TEST
                    (IF @CELLPOINTER("CONTENTS") & "b" (BRANCH START) {UP}(END)(UP)(UP 20)(RIGHT 6)
                    (BLANK TYPE)-
                    (BLANK TYPE)~

(BLANK OFFSET)~

(BLANK PASS)~

(BLANK %FLPREV)~

(BLANK %FL)

RNDPREVADD~
                    (QUIT)~
   ABORT
                    (BLANK TYPE)~
                    (BLANK OFFSET)~
                   {HOME;(GOTO)MESSAGE1-{UP}(DOWN)}
  TYPE
OFFSET
    PASS
 %FLPREV
     %FL
   %FLHI
%FLPOWLO
%FLPOWHI
%FLPOW
  POWADD
 PREVADO
MESSAGE1 PROCESSING ABORTEDIII
                      ENTER EITHER "RECIP", "CENT" OR "SCREW" FOR TYPE OF COMPRESSOR AND RESTART PROCESSING.
                      ALSO, ENTER "W/TURBO" IN SECOND CELL TO RIGHT IF CHILLER WILL BE EQUIPPED WITH TURBO-MODULATOR.
```

Appendix I: ECO-1 (Replace Chillers)

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

	PLANT NO			1	ļ	MASTER	CHILLER	NO (LEA	(D) :		1		-						
1	BUILDING DESIGN L WINTER I	NO: OAD:		121 138 0 EQ-1	Tons %Dsgn	COMPRE CONDEN REFRIGE STATUS:	SER: ERANT;				CENT WATER R-11 EXIST	 							
1	PEAK DE			128.5 244094	KW KWH/YR	CONFIGI	JRATION				SINGLE								
1	DEMAND ENERGY TOTAL C	COST:		\$19,304 \$5,858 \$25,162	MR MR MR	RATED O	MIT: :APACITY		RATE LO	AU:	100 200.0	% TONS							
- 1	UNIT OUT	PUT COST:		\$181	/TONTYR	RATED F		CY:			171.0 0.855	KW/TON	_						
1 1 1	% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHE	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP							
1	*	TONS	TONS	HR/YR	kw	TONS	*	*	*	KW	HR/YR	KWH/YR	_						
	0 W 3 S 4 S 18 S 28 S 28 S 38 S 38 S 58 S 59 S 50 S 50 S 51 S 51 S 52 S 53 S 54 S 55 S 56 S 57 S 58 S 58 S 59 S 50 S 51 S 51 S 51 S 51 S 52 S 53 S 54 S 55 S 56 S 57 S 58	45.5 52.4 59.3 66.2 73.1 80.0 86.9 93.8 100.7 107.6 114.5 121.4 128.3 135.2 142.1 149.0 155.9	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 377 37 50 65 83 108 143 232 259 292 343 381 388 374 357 308 247 71 109 55 7 7 2 0	0.0 44.5 44.5 44.5 44.5 44.5 44.5 44.5 44.5 44.5 44.5 64.7 65.0 65.7 71.8 77.0 82.1 81.8 86.7 71.0 82.1 81.0 10.	0.0 4.1 11.0 17.9 24.8 31.7 38.8 45.5 52.4 59.3 86.2 73.1 80.0 88.9 93.8 100.7 107.8 114.5 124.3 125.2 135.2 142.1 149.0 155.9 182.8	0 2 6 9 12 18 193 28 39 37 40 43 45 57 61 68 71 75 78 81	0 30 30 30 30 30 30 30 30 30 30 37 47 50 54 61 68 71 75 78 81	0 28 28 28 28 28 28 34 34 34 52 55 59 68 70 74	0.0 44.5 44.5 44.5 44.5 44.5 44.5 44.5 4	0 2 10 20 20 20 20 20 20 20 20 20 20 20 20 20	0 0 89 4445 890 14690 14	_						
	PLANT N					MASTER	CHILLER	NO (LE	AD):				MASTER	CHILLER	NO (LAC	1):		3	1
1 1 1	BUILDING DESIGN I WINTER	NO: OAD:		135	TONS	COMPRE	ISER: ERANT:	R NO (LE	AD):	-	RECIP WATER R-12		COMPRI CONDEN	ISER: ERANT:	NO (LAC	1):		RECIP WATER R-22	1
	BUILDING DESIGN I WINTER	NO: .OAD: .OAD: .OOM MODEL: MAND:		135 91 8 0		COMPRE CONDEA REFRIGI STATUS	ESSOR: ISER: ERANT: : URATION	ı			RECIP WATER R-12 EXISTING		COMPRI CONDEN REFRIGI STATUS	ESSOR: ISER: ERANT: : URATION	t	11):		RECIP WATER	1
	BUILDING DESIGN I WINTER SIMULAT PEAK DE CONSUM	NO: OAD: LOAD: ION MODEL: WAND: PTION: COST:		135 91 8 0 EQ-21 89.5 165928 \$13,658	%DSGN KW KWHYR MR	COMPRE CONDEA REFRIGI STATUS	ESSOR: ISER: ERANT: : URATION LD SETP1	ı	AD):	AD:	RECIP WATER R-12 EXISTING		COMPRI CONDEN REFRIGI STATUS	ESSOR: ISER: ERANT: : URATION ISETPON	t	1):		RECIP WATER R-22 EXISTING	* *
	BUILDING DESIGN I WINTER SIMULAT PEAK DE CONSUM DEMAND SHERGY TOTAL C	MAND: COAD: CO		135 91 8 0 EQ-21 89.5 165928 \$13,658 \$3,982 \$17,640	*LDSGN	COMPRICONDES REFRIGI STATUS CONFIGI MAX LEA LOAD LE RATED G RATED G	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY); or PRO- Y:		AD:	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E	% % TONS KW	COMPRI CONDET REFRIG STATUS CONFIG MN LAG LOAD LI	ESSOR: ISER: ERANT: : URATION I SETPOMMIT: CAPACITY POWER:	: NT: Y:	1):		RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E	% % TONS KW
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	BUILDING DESIGN I WINTER SIMULAT PEAK DE CONSUM DEMAND BNERGY TOTAL C UNIT OU'	ANO: .OAD: .OAD: .OAD: .ON MODEL: .ON MODEL: .ON MODEL: .OOST: .OOST: .OOST: .OOST: .PUT COST: .PLANT	PLANT	135 91 E 0 EQ-21 89.5 165928 \$13,658 \$3,992 \$17,640 \$172	*LDSGN KW KWHYR */'R */'R /TON'YR	COMPRISON CONDENS REFRIGION STATUS CONFIGURA LEAL LOAD LEAR LOAD LEAR RATED STATED ST	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY POWER: EFFICIEN	i: or PRO- y: CY:	RATE LO.	AD:	RECIP WATER R-12 EXISTING SINGLE 57 100 73.5 66.2 E 0.901	% % % TONS KW KW/TON ANNUAL	COMPRI CONDER REFRIGI STATUS CONFIG MIN LAG LOAD LS RATED I RATED I RATED I	ESSOR: ISER: ERANT: : URATION SETPORMIT: CAPACITY POWER: EFFICIEN	t: NT: Y: CY:	%	POWER	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900	% TONS KW KW/TON
11 11 11 11 11 11 11 11 11 11 11 11 11	BUILDING DESIGNIUM WINTER SIMULAT PEAK DE CONSUM DEMAND ENERGY TOTAL C UNIT OU' % PLANT DSGN LOAD	MAND: LOAD:	PLANT LOAD SHED	135 91 E 0 EO-21 89.5 185928 \$13,658 \$3,992 \$17,640 \$172 ANNUAL OCCUR ACTUAL	KW KWHYR / / / / / / / / / / / / / / / / / / /	COMPRISON CONTROL CONT	ESSOR: ISER: ISER: INTERPORT OF THE POWER: ISERIANT: ISERIANT: INTERPORT OF THE POWER: ISERIANT:	CY: SAT CAP ADJ	RATE LO. % RAT POW	POWER	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR ADJUST	% ** TONS KW KW/TON ANNUAL ENERGY CONSUMP	COMPRI CONDEN REFRIG STATUS CONTEN MN LAG LOAD LE RATED I RATED I CHL LOAD	ESSOR: ISER: ISER: URATION ISETPORMIT: CAPACITY POWER: EFFICIEN: RAT CAP ACT	CY:	% RAT POW		RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST	% TONS KW KW/TON ENERGY CONSUMP
	BULDING DESIGNI WINTER SIMULAT PEAK DE CONSUM DEMAND BNERGY TOTAL C UNIT OU' % PLANT DEGAN LOAD	NO: OAD: OAD: OAD: OAD: OAD: OAD: OAD: OA	PLANT LOAD	135 91 8 0 EO-21 89.5 185928 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUIR ACTUAL	*LDSGN KW KWHYR */'R */'R /TON'YR	COMPRISON CONDENS REFRIGION STATUS CONFIGURA LEAL LOAD LEAR LOAD LEAR RATED STATED ST	ESSOR: ISER: ERANT: ERANT: ERANT: CAPACITY OWER: EFFICIEN RAT CAP	CY:	RATE LO.		RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR	% TONS KW KW/TON ANNUAL ENERGY	COMPRI CONDER REFRIGI STATUS CONFIG MIN LAG LOAD LS RATED I RATED I RATED I	ESSOR: ISER: ERANT: : URATION ISETPORMIT: CAPACITY POWER: EFFICIEN RAT CAP	: NT: Y: CY:	% RAT	ĸw	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR	% % TONS KW KW/TON
11 11 11 11 11 11 11 11 11 11 11 11 11	BULDING DESIGN I WINTER SIMULAT PEAK DE CONSUM DEMAND ENERGY TOTAL C UNIT OU' * UNIT OU' O W 3 S 8 S	NO: OAD: OAD: OAD: OAD: ON MODEL: MAND: PTION: COST: COST: PUT COST: PLANT LOAD TONS 0.0 2.7 7.3	PLANT LOAD SHED TONS	135 91 1 2 0 EO-21 89.5 1 185928 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HRLYR 4380 37 50	%DSGN KW KWHYR YR YR YR YR YR YR ITON'YR PLANT DEMAND KW 0.0 28.8 28.8	COMPRISON CONDENSITY OF THE PROPERTY OF THE PR	ESSOR: ISER: ISER: ISERANT: ISERITION INDICATION INDICA	CY: RAT CAP ADJ % 0 30	RATE LO. % RAT POW % 0 23 23	POWER KW 0.0 15.2 15.2	RECIP WATER R-12 EXISTING 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUP ADJUST HR/YR	TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR 0 30 152	COMPRICONDEN REFRIG STATUS CONFIG MN LAG LOAD LI RATED 0 RATED 1 RATED 1 TONS 12 3.11	ESSOR: SER: ERANT: : URATION IS SETPORMIT: CAPACITY POWER: EFFICIEN ACT 0 2 6	CY: RAT CAP ADJ 30 30	% RAT POW %	0.0 11.4 11.4	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST	% TONS KW KW/TON ANNUAL ENERGY CONSUMP O
	BULLDING DESIGN IV WINTER SIMULAT PEAK DE CONSUM DEMAND EMERGY TOTAL C UNIT OU' * PLANT DSGN LOAD 0 W 3 S 18 S 18 S	OO. OAD: OAD: OAD: OAD: OAD: ON MODEL: WAND: PTION: COST: COST: COST: PUT COST: PUT COST: TONS 0.0 2.7 7.3 11.8 16.4	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0	135 91 1 2 0 EO-21 80.5 185928 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65	KW KWHYR AYR AYR AYR AYR AYR AYR AYR AYR AYR A	COMPRISON CONDENSITY OF THE PROPERTY OF THE PR	ESSOR: ISER: ISER: ISERANT: IURATION IU	CY: CY: ADJ 0 30 30 30 30 30	RATE LO. % RAT POW % 23 23 23	POWER KW 0.0 16.2 15.2 15.2 15.2 15.2	RECIP WATER R-12 EXISTING 57 E 100 73.5 86.2 E 0.901 ANNUAL OCCUP ADJUST HRYR	% KW KW/TON ANNUAL ENERGY CONSUMP 0 300 152 304 547	COMPRICONDER CONDER REFRIEGO STATUS CONFIG MN LAG LOAD LI RATED I RATED I CHL LOAD TONS 0.0 12 3.1 5.1 7.1	ESSOR: ISER: ISER: ISER: ISERANT: ISERA	CY: ** ** ** ** ** ** ** ** **	% RAT POW % 23 23 23 23 23	0.0 11.4 11.4 11.4 11.4	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HR/YR	% % % KW KW/TON ANNUAL ENERGY CONSUMP 0 0 0 23 68 182
	BULLDING DESIGN IV WINTER SIMULAT PEAK DE CONSUM DEMAND ENERGY TOTAL C UNIT OU' % PLANT DSGN LOAD % 0 W 3 S 8 S 18 S 23 S 23 S 28 S 28 S	NO: .OAD: .O	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0	135 91 ti 1 0 DCO-21 89.5 ti 155928 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 377 500 65 83 106	MDSGN	COMPRICONDES CONDES CONTRO CONFIGURA	ESSOR: ISER: ISER: ISER: INTERPRETATION INDICATION INDI	CY: KAT CAP ADJ 30 30 30 30 30 30 30	RATE LO. % RAT POW % 23 23 23 23 23 23	POWER KW 0.0 15.2 15.2 15.2 15.2 15.2 15.2	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 86.2 E 0.901 ANNUAL OCCUR ADJUST HR/YR 0 2 2 10 26 55 7 95	TONS KW KW/TON ANNUAL ENERGY CONSUMP 0 30 152 304 547 886 1446	COMPRICONDER CONDER REFRIEGO STATUS CONFIG MN LAG LOAD LI RATED I RATED I CHIL LOAD TONS 0.0 12 2.1 5.1 7.1 9.0 11.0	ESSOR: URATION SETPOR MIT: CAPACITY POWER: EFFICIEN AAT CAP ACT 0 2 6 9 13 166 20	CY: RAT CAP ADJ 30 30 30 30 30 30 30	% RAT POW % 23 23 23 23 23 23 23 23 23 23	0.0 11.4 11.4 11.4 11.4 11.4 11.4	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HRAYR 0 0 2 2 6 18 30 83	%
	BUILDING BUILDING BUSINGNI WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DHERGY TOTAL C UNIT OU' * PLANT DSQN LOAD * 0 W 3 S 13 S 18 S 28 S 28 S 33 S 33 S	NO: .OAD: .O	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	135 91 if 1 0 EO-21 89.5 in 55928 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 37,7 500 85,83 106 143 184 232	MDSGN	COMPRICONDEN CONDEN CONDEN CONFIGURA	ESSOR: ISER: ISER: IURATION NO SETPI MUT: CAPACITY POWER: EFFICIEN AAT CAP ACT % 18 19 19 19 19 20 23	CY: CY: CAP ADJ 30 30 30 30 30 30 30 30 30 3	RATE LO. % RAT POW % 23 23 23 23 23 23 23 23	POWER 6.0 16.2 15.2 15.2 15.2 15.2 15.2 15.2 15.2 15	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 86.2 E 0.901 ANNUAL OCCUR ADJUST HRAYR 0 2 2 10 20 38 57 95 141 209	% ** ** ** ** ** ** ** ** **	COMPRICONDER CONDEN REFRIEIGN STATUS CONFIG MN LAG LOAD LI RATED I RATED I CHIL LOAD TONS 0.0 1.2 2.1 5.1 7.1 1.0 11.0 11.0 11.9	ESSOR: ISER: ISER: ISER: INTERPORMIT: INTERP	CY: CY: CAP ADJ 30 30 30 30 30 30 30 30 30 3	% RAT POW % 23 23 23 23 23 23 23 23 23 23 23 23 23	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4 1	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HR/YR 0 0 2 16 30 63 108	% % % KW KW/TON ANNUAL ENERGY CONSUMP 0 23 182 342 342 342 1718 1231 1243
	BULLDING DESIGN IN WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TOTAL ** O W 3 S 8 S 8 S 18 S 23 S 23 S 34 S 34 S 55 S 55 S	OO. OAD: OAD: OAD: OAD: OAD: OAD: ON MODEL: WAND: PTION: COST: COST: COST: DST: PUT COST: TONS O.0 2.7 7.3 11.8 18.4 20.9 25.5 30.0 34.8 39.1 43.7 48.2	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0	135 91 ti 0 EO-21 83.5 185928 \$13,858 \$3,982 \$17,840 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 55 83 106 143 184	#LDSGN KW KWHYR //R //R //R //R //R //R //TONTYR PLANT DEMAND KW 0.0 26.6 26.6 26.6 26.5 26.5 26.5 26.5 26.5 26.5	COMPRIGORDER CONDENT CONDENT CONFIGURATION CONFIGURATION RATED 0 RATED 0 RATED 0 RATED 1 RATED 0 RATED	SSOR: ISER: ISER: ISER: ISER: ISER: IURATION ID SETP1 IURATION IUR	CY: CY: KAT CAP ADJ 30 30 30 30 30 30 30 30 30 30 30 30 30	** RATE LO. ** RAT POW ** 0 23 23 23 23 23 23 27 29	POWER 0.0 15.2 15.2 15.2 15.2 15.2 15.2 15.2	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL ADJUST HRAYR 0 2 2 10 20 38 57 95 141	% ** ** ** ** ** ** ** ** ** *	COMPRICONDER CONDER CONFIGURATION CONFIGURATION RATED I RATED I LOAD I TONS 0.0 1.2 3.1 5.1 7.1 9.0 11.0 12.0	ESSOR: ISER: ERANT: : : : : : : : : : : : : : : : : : :	**CY: **CY: **AT CAP ADJ **O 30 30 30 30 30 30 30 30 30 30 30 30 30	% RAT POW % 23 23 23 23 23 23	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL ANDUST HR/YR 0 0 2 6 18 30 63 108	% TONS KW
	BUILDING BUILDING BUSINGNI WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TOTALO V. PANT DSQN 3 S 3 S 3 S 3 S 44 S 53 S 54 S 55 S 63 S	NO: .OAD: .O	PLANT LOAD SHED TONS	135 91 1 1 0 EO-21 813 185928 \$13,858 \$3,982 \$17,640 OCCUR ACTUAL HR/YR 4380 85 83 106 143 184 222 259 292 343 381 388	#MDSGN KW KWHYR //R //R //R //R //TONTYR PLANT DEMAND KW 0.0 1 26.8 1 26.6 26.5 26.5 26.5 26.5 26.5 26.5 26.5	COMPRICONDER CONDEN CONDEN CONFIGURA	ESSOR: ISSER: URATION LO SETPI / ISSER: URAT	"CY: "%" "ADJ "0 "30 "30 "30 "30 "30 "30 "30 "30 "30	% RATELO. % RAT POW % 0 23 23 23 23 23 23 23 23 23 23 23 23 23	POWER KW 0.0 162 152 152 152 152 152 152 152 152 152 245	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR ADJUST HR/YR 0 2 2 10 26 57 95 141 2099 2599 2493 341 388	% TONS KW KWITON I BHERGY CONSUMP O 152 304 547 886 1444 2143 3177 5227 5588 8573 9508	COMPRICONDER CONDER CONFIGURATION CONFIGURATION RATED I RATED I RATED I RATED I RATED I 12 3.1 5.1 7.1 9.0 11.0 12.9 14.3 18.8 18.8 20.7 22.7	ESSOR: ISER: ISER: URATION ISETPOMENT IN ISER POMENT IN ISER POMEN	CCY: ** ** ** ** ** ** ** ** **	% RAT POW % 0 23 23 23 23 23 24 27 30 34 36	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4 1	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HR/YR 0 0 2 2 6 16 30 63 31 108 118 259 292 343 381 388	% TONS KW
	BUILDING BUILDING DESIGN IN WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TOTAL UNIT OU * PLANT DESON LOAD 0 W 3 S 8 S 23 S 23 S 23 S 24 S 23 S 24 S 25 S 26 S 27 S 27 T	NO: .OAD: .O	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	135 91 ti 1 0 EO-21 80.5. 185528 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 106 143 184 232 259 202 343 381 388 374 357	#MDSGN KW KWHYR //R //R //R //TONTYR PLANT DEMAND KW 0.0 26.8	COMPRICONDER CONDEN CONDEN CONFIGURA	ESSOR: ISER: ERANT: URATION (D SETPI) WITH TOWER: CAPACITY CAPACIT	"CY: "%" "ADJ "0 30 30 30 30 30 30 30 30 34 41 44 48	% RATELO. % RAT POW % 0 23 25 25 25 25 25 25 25 25 25 25 25 25 25	POWER 0.0 16.2 15.2 15.2 15.2 15.2 15.2 15.2 22.5 24.5 24.5 27.8 29.1	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUP ADJUST HR/YR 0 2 2 10 20 36 57 95 141 209 259 259 243 381 388 374 357	% TONS KW KWITON ANNUAL ENERGY CONSUMP 0 30 152 304 2143 3177 39207 5227 5586 8573 9506 10397 10389	COMPRICONDER CONDER CONFIGURATION CONFIGURATION RATED I RATED I RATED I RATED I RATED I 12 3.1 5.1 7.1 9.0 11.0 12.9 14.9 14.9 14.9 14.9 14.9 14.9 14.9 14	ESSOR: ISER:	CY: ** ** ** ** ** ** ** ** **	% RAT POW % 0 23 23 23 23 23 24 27 30 34 42 45 45	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4 1	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HR/YR 0 0 2 16 30 63 30 63 31 08 188 259 299 294 381 388 374 357	% TONS KW
	BUILDING BUILDING DESIGN IN WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TOTAL V PLANT LOAD V 18 S 18 S 28 S 33 S 44 S 54 S 55 S 56 S 57 S 58 S 68 S 77 S 58 S	NO: .OAD: .O	PLANT LOAD SHED 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	135 91 t 1 0 EO-21 80.5 185528 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106 143 31 184 232 259 299 299 299 343 381 381 381 381 381 381 381 381 381 38	KW KWHYR NR	COMPRICONDEN CONDENS CONTROL C	ESSOR: ISER: ERANT: URATION (D SETPI) WITH TOWER: CAPACITY CAPACIT	"CY: "%" "ADJ "0 30 30 30 30 30 30 30 30 34 41 48 48 55	% RATELO. % RAT POW % 0 23 23 23 23 23 23 23 23 23 23 24 44 48 51	POWER KW 0.0 15.2 15.2 15.2 15.2 15.2 15.2 15.2 24.5 27.9 19.2 24.5 27.8 31.8 33.8	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR ADJUST HR/YR 0 2 10 20 36 57 95 141 209 229 229 343 381 388 374 357 308 247 308	% KW KW/TON ANNUAL ENERGY CONSUMP 0 30 152 304 2143 3177 3927 55227 6558 8573 9506 10387 10389 9794 8349	COMPRI CONDEN CONDEN CONDEN CONDEN CONTROL CON	ESSOR: ISER: URATION ISETPOP IN ISER ISER: URATION ISETPOP IN ISER ISER ISER ISER ISER ISER ISER ISER	CY: ** ** ** ** ** ** ** ** **	% RAT POW % 0 23 23 23 23 24 27 30 34 42 45 48 51	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.9 13.3 14.8 20.7 22.2 23.7 25.2	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HRAYR 0 0 2 63 30 63 108 188 259 222 343 381 388 374 357 308	% TONS KW TONS KW TONS KW TONS TONS
	BUILDING BUI	NO: .OAD: .O	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	135 91 it is 0 EO-21 80.5 185528 \$13,858 \$3,982 \$17,640 \$172 ANNUAL OCCUR ACTUAL HR/YR 4380 377 50 65 83 106 143 318 4232 2259 259 259 259 259 277 383 384 374 357 367 368 374 377 388 374 377 388 374 377 388 374 377 377 388 374 377 377 377 377 377 377 377 377 377	KW KWHYR NR	COMPRICONDEN CONDEN CONDEN CONFIGURA	SSOR: SSER:	"CY: "%" "ADJ "CAP ADJ "30 30 30 30 30 30 30 41 44 48 55 59 62	% RATELO. % RAT POW % 0 23 23 23 23 23 23 23 23 24 44 48 55 55	POWER KW 0.0 15.2 15.2 15.2 15.2 15.2 15.2 15.2 24.5 27.9 19.2 24.5 27.9 31.8 35.7 38.4	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR ADJUST HR/YR 0 2 10 20 36 57 95 141 209 259 259 259 259 259 259 259 259 259 25	% KW KW/TON ANNUAL ENERGY CONSUMP 0 30 152 304 2143 3177 3937 5227 6558 8573 9506 10387 10389 9704 8349 8105 4188	COMPRI CONDEN CONDE CONDEN CONDE CONDEN CONDEN CONDEN CONDEN CONDE CONDEN CONDE CONDEN CONDE CONDE CONDE CONDE CONDE CONDE CONDE	ESSOR: ISSER: URATION ISSEROR. URATION ISSEROR	CCY:	% RAT POW % 0 23 23 23 24 24 7 27 3 3 4 4 5 4 8 5 1 5 5 5 8	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.9 13.3 14.8 18.8 20.7 22.2 23.7 25.2 28.7	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HRAYR 0 0 2 63 108 188 259 202 343 381 388 374 357 308 247 171 100	%
	BULLDING DESIGN IN WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TO UNIT OU *LOAD O WAR 3 S S S S S S S S S S S S S S S S S S	NO: OAD: OAD: OAD: OAD: OAD: OAD: OAD: OA	PLANT LOAD SHED 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	135 91 11 10 10 10 10 10 10 10 10 10 10 10 10	MDSGN KW KWHYR //R //R //TON'YR PLANT DEMAND 628.8 28.8 28.8 28.8 28.8 28.8 28.8 28	COMPRICONDEN CONTROL C	SSOR: SSER:	CY: % RAT CAP ADJ 30 30 30 30 30 30 30 41 44 48 51 55 59 62	% PATELO. % RAT POW % 23 23 23 23 23 23 24 24 44 851 54	0.0 16.2 15.2 15.2 15.2 15.2 15.2 15.2 15.2 15	RECIP WATER R-12 EXISTING SINGLE 57 E 100 T3.5 66.2 E 0.901 ANNUAL COCUMA ADJUST HRAYR 0 2 2 10 20 38 57 95 141 209 259 292 343 381 388 374 357 308 247 171	%	COMPRICONDER CONDER CONDER GERRIGO STATUS CONFIGURA MN LAGA LOAD LI RATED I RATED I RATED I RATED I 100 110 110 110 120 110 120 110 120 120	ESSOR: ISER: URATION ISER: EFRANT: EFRANT: ISER: EFRANT: ISER: EFRANT: EFR	**CY: ** ** ** ** ** ** ** ** **	% RAT POW % 0 23 23 23 24 27 35 03 44 24 45 55 55	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4 1	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 0.900 ANNUAL OCCUP ADJUST HR/YR 0 0 0 2 2 6 18 30 63 108 259 292 343 381 388 259 292 343 374 357 308 374 357 308 247 171	% TONS KW KW/ON
	BUILDING BUILDING DESIGN IN WINTER SIMULAT PEAK DE CONSUM DEMAND DEMAND DEMAND TOTAL V PLANT DSQN LOAD V 13 S	NO: .OAD: .O	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	135 91 11 0 0 EO-21 135 1552 8 13.858 3.982 17.840 0 5172 ANNUAL OCCUR ACTUAL HR/YR 4380 37.7 50 65 83 106 143 38 134 232 259 259 259 259 259 271 100 9 59 9 25 5	KW KWHYR / NR /	COMPRICONDEN CONDEN CONDEN CONFIGURA	SSOR: SSER: URATION OF SEPANT: URATION OF SEPANT: CAPACITY COWER: CAPACITY	CY: % RAT CAP ADJ 30 30 30 30 30 30 30 41 44 48 81 51 55 9 62 66 69 73	% RATELO. % RAT POW % 22 22 23 23 23 23 23 24 44 48 51 58 61 15 55 65 61 65 58	POWER KW 0.0 0.0 15.2 15.2 15.2 15.2 15.2 15.2 15.2 24.5 27.8 29.1 31.8 35.7 38.4 40.4 43.4	RECIP WATER R-12 EXISTING SINGLE 57 E 100 73.5 66.2 E 0.901 ANNUAL OCCUR ADJUST HRAYR 0 2 10 20 36 57 95 141 209 259 292 343 381 388 374 7308 247 171 109 59 25	% KW KW/TON ANNUAL ENERGY CONSUMP O	COMPRI CONDEN CONDE CONDEN CONDE CONDEN CONDEN CONDEN CONDEN CONDE CONDEN CONDE CONDEN CONDE CONDE CONDE CONDE CONDE CONDE CONDE	ESSOR: ISSER: URATION ISSERDANT: URATION ISSERDANT: CAPACITY CAPAC	CY:	% RAT POW %	0.0 11.4 11.4 11.4 11.4 11.4 11.4 11.4 1	RECIP WATER R-22 EXISTING SINGLE NA 100 54.9 E 49.4 E 0.900 ANNUAL OCCUR ADJUST HRAYR 0 0 0 2 2 6 16 30 63 108 188 259 252 349 381 388 374 7371 100 59 255	% TONS KW TONS KW MW/TON MNUAL ENERGY CONSUMP MW/TON MW

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT N BUILDING DESIGN WINTER SIMULAT PEAK DE CONSUM DEMAND BNERGY TOTAL O	MAND: DOST: COST: COST:		3 194 107 0 EQ-1 91.5 195214 \$13,963 \$4,885 \$18,648	TONS 1 %DSGN KW KWHVYR MR MR MR MR MR MR MR	MASTER COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIM	SSOR: SER: RANT: RATION: D SETPT	or PRO-I		AD:	CENT WATER R-12 EXISTING SINGLE NA 100	*	•						
	TPUT COST:		\$154	/TONTYR	RATED P	OWER:				199.0 0.873	KW/TON							
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHE	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP							
*	TONS	TONS	HRYR	_ <u>kw</u>	TONS	*	*	*	KW	HR/YR	KWHYR	-						
83 : 84 : 93 : 94 : 103 : 108 : 113 :	3.2 8.8 5 13.9 19.3 5 24.6 30.0 35.3 40.7 48.0 5 51.4 56.7 62.7 62.7 72.8	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 7 97 85 83 108 143 143 1232 259 292 292 343 381 1388 374 357 708 109 109 109 109 109 109 109 109 109 109	0.0 61.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7 61.7 62.7 62.8 63.	0.0 3.2 8.8 13.9 19.3 24.8 30.0 35.3 40.7 48.0 51.4 56.7 62.1 67.4 72.8 83.5 88.8 94.2 99.5 104.9 102.9 126.3	0 14 8 8 11 15 120 23 225 27 30 23 24 37 39 44 48 48 51 53 55	0 30 30 30 30 30 30 30 30 30 30 30 30 30	06 28 28 28 28 28 28 28 28 28 28 28 28 28	0.0 51.7 51.7 51.7 51.7 51.7 51.7 51.7 51.7	0 1 7 13 22 9 82 92 92 92 92 92 92 92 92 92 92 92 92 92	0 52 382 137 2018 3205 4758 1158 1158 1158 1158 11733 20080 11577 8022 4480 1900 585 175 0							
PLANT N					MASTER	CHILLER	NO (LE	AD):				MASTER	CHILLER	NO (LAC	1):		7	
BUILDIN DESIGN WINTER SIMULA	LOAD:	:	410 238 0 EQ-2M	TONS MDSGN	COMPRE CONDEN REFRIGI STATUS	ISER: ERANT:				CENT WATER R-12 EXISTING		COMPRE CONDEN REFRIGI STATUS	SER: ERANT:				CENT WATER R-12 EXISTING	3
PEAK DI CONSUI DEMANI	UPTION: D COST:		158.0 371264 \$24,111	KW KWHYR YR	CONFIGURAL LOAD LI	D SETP1	: f or PRO-	RATELO	AD:	PARALLE 80 100	* *		JRATION: SETPOIN WIT:				PARALLE NA 100	1 % %
TOTAL O	COST:		\$8,910 \$33,021	MR MR	RATED (POWER:				110.0 79.0 0.718	TONS KW KW/TON	RATED	APACITY OWER:				110.0 79.0 0.718	TONS KW KW/TON
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL	RAT CAP ACT	RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
*	TONS	TONS	HAYR	KW	TONS	*	*	*	ĸw	HR/YR	KWH/YR	TONS	*	*	*	KW	HR/YR	KWH/YR
3 13 13 13 14 15 15 15 15 15 15 15	W 0.0 S 30.0 S 71.1 S 19.0 S 30.0 S 30.0 S 30.0 S 30.0 S 55.4.7 S 568.6 S 78.5 S 102.3 S 114.2 S 1128.1 S 138.0 S 149.9 S 185.6 S 209.4 S 123.3 S 233.2 S 245.1 S 255.2 S 288.9 S 288.9 S 288.9 S 288.9 S 288.9 S 288.9	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4980 85 83 106 84 143 184 222 259 243 343 381 388 374 377 308 247 171 109 55 7	0.0 i 20.5 : 20.5 : 20.5 : 20.1 : 33.2 : 41.1 : 49.0 : 53.8 : 60.8 : 60.	0.0 0.0 7.1 1 19.0 30.9 42.8 54.7 88.8 6 78.5 145.2 57.1 1 63.1 63.0 98.0 98.0 110.0 110.0 110.0 110.0 110.0 110.0 110.0 110.0	0 6 6 17 28 39 95 61 71 71 75 75 76 83 74 79 95 100 100 100 100 100 100 100 100 100 10	0 30 30 39 50 61 71 41 47 52 57 83 88 74 79 84 95 100 100 100	0 28 28 28 28 33 42 52 34 39 43 48 54 59 65 71 177 85 92 100 100 100 100 100 100 100 100 100 10	0.0 20.5 20.5 20.5 28.1 33.2 41.1 49.0 28.9 30.8 34.0 37.9 42.7 46.8 67.2 72.7 79.0 79.0 79.0 79.0	0 7 28 61 11 83 100 143 144 232 255 202 343 381 388 374 357 308 247 171 109 59 25 7	0 0 144 574 1251 2186 3519 9016 6241 7977 9928 13000 18269 18081 19224 420023 18726 1858 12432 553 158 0 0	0.0 0.0	0 0 0 0 0 0 0 0 0 41 45 52 57 63 68 74 79 95 100 100 100 100	0 0 0 0 0 0 0 0 41 46 52 57 63 63 68 74 79 84 90 100 100 100 100 100	0 0 0 0 0 0 0 34 38 54 48 59 85 71 77 85 92 100 100 100	0.0 0.0 0.0 0.0 0.0 0.0 0.0 26.9 30.0 34.0 34.0 37.9 42.7 46.8 67.2 72.0 79.0 79.0 79.0 79.0	0 0 0 0 0 0 0 232 259 243 381 388 374 357 308 247 171 100 59 255 7	0 0 0 0 0 0 0 0 6241 7770 9928 13000 16265 1808 1808 18726 18598 12432 88111 4681 1975 553 1875 553 1875
i I			8602							4168	197009	1					3554	174255

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

8	LANT BULDI DESIG VINTE	NG N L	NO: OAD:		6 2805 116 0 EQ-1	Tons :	COMPRICONDEN	SER:	NO (LE	AD):		CENT WATER R-113	
i	EAK I	D EN	AND:		115.9	KW	SIATUS	Ç				EXIST	
(XXII	JMF	TION		216891	KWHYR		URATION				SINGLE	
					447.000	!			or PRO-	RATELO	AD:	NA	%
			COST:		\$17,886	/YR I	LOAD LI	MIT:				100	%
	OTAL				\$5,205	AA I	DATED	CAPACITY				149.8	TONS
	UIAL	CC	A51;		\$22,892	/fm	RATED		1:			149.8 134.8 E	
ı	NIT C	UT	PUT COST:		\$175	/TON"YR		EFFICIEN	CY:			0.900	KW/TON
						- 							
	6 LANT		PLANT LOAD	PLANT LOAD	ANNUAL OCCUR	PLANT DEMAND	CHIL	% RAT	%	% RAT	POWER	ANNUAL OCCUR	ANNUAL
	SON		LOAD	SHED	ACTUAL	DEWAYD	LOAD	CAP	RAT	POW			ENERGY
	OAD			SHED	ACTUAL			ACT	CAP	POW		ADJUST	CONSUMP
•			TONS	TONS	HR/YR	kw	TONS	*	%	%	ĸw	HRYR	KWHYR
		w	0.0	0.0	4380	0.0 1	0.0				0.0		0
	3	s	3.5	0.0	37	35.0	3.5	2	30	26	35.0	2	70
		s	9.3	0.0	50	35.0	9.3	8	30	26	35.0	10	350
	13	S	15.1	0.0	65	35.0	15.1	10	30	26	35.0	22	770
	18	S	20.9	0.0	23	35.0	20.9	14	30	26	35.0	39	1365
	23	S	26.7	0.0	108	35.0	26.7	18	30	26	35.0	64	2240
	28	S	32.5	0.0	143	35.0	32.5	22	30	26	35.0	105	3675
	33	s	38.3	0.0	184	35.0	38.3	26	30	26	35.0	159	5565
	38	S	44.1	0.0	232	35.0	44.1	29	30	26	35.0	224	7840
	43	S	49.9	0.0	259	37.7	49.9	33	33	28	37.7	259	9764
	48	S	55.7	0.0	292	41.8	55.7	37	37	31	41.8	292	12206
	53	s	61.5	0.0	343	45.8	81.5	41	41	34	45.8	343	15700
	58 83	S	67.3 73.1	0.0 0.0	381 388	51.2 55.3	67.3 73.1	45	45	38 41	51.2	381	19507
	68	5	78.9	0.0	388	59.3	78.9	53	53	44	55.3 59.3	388 374	21456 22178
	73	S	84.7	0.0	357	64.7	84.7	53 57	57	48	64.7	374	23098
	78	5	90.5	0.0	308	68.7	90.5	60	60	51	68.7	308	23098
	83	Š	96.3	0.0	247	74.1	96.3	64	64	55	74.1	247	18303
	88	Š	102.1	0.0	171	79.5	102.1	68	8.8	59	79.5	171	13595
	93	s	107.9	0.0	109	84.9	107.9	72	72	63	64.9	109	9254
	98	s	113.7	0.0	59	91.7	113.7	76	76	68	91.7	59	5410
	103	S	119.5	0.0	25	97.1	119.5	80	80	72	97.1	25	2428
	108	S	125,3	0.0	7	103.8	125,3	84	84	77	103.8	7	727
	113		131.1	0.0	2	110.5	131.1	88	88	82	110.5	2	221
	118	S	136.9	0.0	0	115.9	136.9	91	91	86	115.9	0	0
					8502							3947	216891

PEAK D CONSUI DEMAN ENERGY TOTAL	IG NO: LOAD: LOAD: TION MODEL: BMAND: MPTION: D COST: Y COST:		7 5784 210 £ 0 EO-2M 227.9 406474 \$34,778 \$9,755 \$44,533 \$188	TONS %DSGN KW KWHYYR YR YR YR YR YR YR	COMPRI CONDEN REFRIG STATUS CONFIG MAX LEA LOAD LI	URATION AD SETPT MIT: CAPACITO POWER:	: For PRO- Y:	AD):	AD:	CENT WATER R-113 EXISTING PARALLE 80 100 178.0 160.2 E 0.900	EL % % TONS	COMPRICONDED REFRIG STATUS CONFIG MIN LAG LOAD LI RATED	VSER: ERANT: : URATION SETPOI MIT; CAPACIT	i: NT: Y:	G 1):		10 RECIP AIR R-22 EXISTING PARALLE NA 100 71.6 71.6 1.000	i
% PLANT DSGN LOAD	PLANT LOAD.	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL LOAD	RAT CAP ACT	RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
*	TONS	TONS	HR/YR	KW	TONS	%	%	%	KW	HRYA	KWHYR	TONS	%	*	%	ĸw	HR/YR	KWHYR
0 1	W 0.0 S 6.3	0.0	4380 37	0.0 41.7	0.0 8.3	0	30	0 25	0.0 41.7	0 5	0 209	0.0	0	0	0	0.0	0	0 1
	S 16.8	0.0	50	41.7	18.8	•	30	26	41.7	15	828	0.0		0	0	0.0	0	0 1
	5 27.3	0.0	85	41.7	27.3	15	30	26	41.7	33	1378	0.0	0	0	ŏ	0.0	ň	8 1
18	5 37.8	0.0	83	41.7	37.8	21	30	26	41,7	58	2419	0.0	o	ŏ	ŏ	0.0	ŏ	ŏi
	5 48.3	0.0	108	41.7	48.3	27	30	26	41.7	95	3962	0.0	0	Ó	ō	0.0	0	ō i
	58.8	0.0	143	44.9	58.8	33	33	28	44.9	143	6421	0.0	0	0	0	0.0	0	οj
	5 69.3	0.0	184	52.9	89.3	39	39	33	52.9	184	9734	0.0	0	0	0	0.0	0	0
	5 79.8 5 90.3	0.0	232 259	60.9 67.3	79.8 90.3	45 51	45 51	38 42	60.9 67.3	232 259	14129 17431	0.0	0	0	0	0.0	0	0 1
	5 100.8	0.0	292	76.9	100.8	57	57	48	78.9	292	22455	0.0		0	v	0.0	0	0 1
	5 111.3	0.0	343	86.5	111.3	63	63	54	88.5	343	29870	0.0	ŏ	ů	ŏ	0.0	0	0 1
58	5 121.8	0.0	381	94.5	121.8	88	68	59	94.5	381	38005	0.0	ő	ŏ	ŏ	0.0	ŏ	0 1
	5 132.3	0.0	388	104.1	132.3	74	74	55	104.1	388	40391	0.0	o	0	ō	0.0	ō	0
	5 142.8	0.0	374	112.0	101.8	57	57	48	76.9	374	28761	41.0	57	57	49	35.1	374	13127
73		0.0	357	121.2	109.3	81	61	52	83.3	357	29738	44.0	61	61	53	37.0	357	13530
78 83		0.0	308	132.8	118.8	66	66	57	91.3	308	28120	47.0	66	66	58	41.5	308	12782
	5 174.3 5 184.8	0.0	247 171	142.1 151.4	124.3 131.8	70 74	70 74	61 65	97.7 104.1	247 171	24132	50.0 53.0	70 74	70 74	62	44.4	247	10987
	5 195.3	0.0	109	162.9	139.3	78	78	70	112.1	109	17801 12219	56.0	78	78	86 71	47.3 50.8	171 109	8088
	5 205.8	0.0	59	174.8	146.8	82	82	75	120.2	59	7092	59.0	82	78 82	76	50.8 54.4	109 59	5537 3210
103		0.0	25	188.5	154.3	87	87	81	129.8	25	3245	62.0	87	87	82	58.7	25	1488
	5 228.8	0.0	7	200.1	181.7	91	91	86	137.8	7	965	65.1	91	91	87	62.3	7	436
113		0.0	2	214.0	169.2	95	95	92	147.4	2	295	68.1	95	95	93	66.6	2	133
118	5 247.8	0.0	0	227.9	176.7	99	99	98	157.0		0	71.1	99	99	99	70.9	ō	0
			8502	i						4087	337196						1659	69278

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT NO BUILDING DESIGN L WINTER L SIMULATI PEAK DES CONSUMI	I NO: .OAD: LOAD: ION MODEL: WAND: PTION:		8 5792 176 0 EQ-1 157.0 351948 \$23,958	TONS %DSGN KW KWHYR	MASTER COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA	SSOR: SER: RANT: RATION: D SETPT			.D:	11 CENT WATER R-113 EXISTING SINGLE NA 100	*							
ENERGY TOTAL CO	COST:		\$8,447 \$32,405	MR I	RATED C	OWER:				170.0 157.0 0.924	TONS KW KW/TON							
UNIT OUT	PUT COST:		\$191	/TONTYR	RATED E			*	POWER	ANNUAL	ANNUAL	•						
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	RAT CAP ACT	RAT CAP ADJ	RAT POW	rowen	OCCUR	ENERGY CONSUMP							
, *	TONS	TONS	HR/YR	KW i	TONS	*	*	<u>*</u>	KW .	HR/YR	KWHYR							
0 W 3 5 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 3 5 1 5 5 5 5	5.9 is 10.2 is	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 37, 50 85, 83 108 143, 184 232, 259 292, 343 381, 188 374, 357, 308 247, 711 109, 50 25, 7	0.0 40.8 40.8 40.8 40.8 40.8 40.8 40.8 40.8 40.8 51.8 59.7 55.9 72.2 50.1 57.9 55.9 55.8 105.0 116.2 125.0 146.0 157.0 157.0 157.0 157.0 157.0 157.0 157.0	5.0 5.3 14.1 22.9 31.7 40.5 49.3 58.1 68.9 75.7 84.5 93.3 102.1 110.9 119.7 128.5 137.3 146.1 154.9 163.7 170.0 170.0 170.0	0 3 8 13 19 24 29 34 39 45 50 55 70 85 77 81 86 91 98 100 100 100	0 30 30 30 30 30 34 39 45 55 80 85 70 78 81 86 91 91 100 100	0 26 26 26 26 28 29 33 34 42 45 1 56 61 00 100 100 100 100 100 100 100 100	0.0 40.8 40.8 40.8 40.8 40.8 45.5 51.7 65.9 72.2 80.1 87.9 95.8 116.2 125.8 146.0 157.0 157.0 157.0	0 4 13 28 53 53 53 138 184 232 259 243 381 381 374 377 308 247 171 109 59 50 7	0 163 530 1142 2162 3468 3468 3468 3672 12018 15462 19243 24765 35529 35720 31023 23065 15914 9263 1099 3142 1091 15914 9263 1099 3142 1091 15914 9263 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 1099 3142 344							
!			8602							4059	351948	-						
PLANT N BUILDING DESIGN WINTER SIMULAT	G NO: LOAD:	<u>.</u>	9 7050 306 15 EQ-2M	TONS %DSGN	COMPRI CONDE REFRIG	VSER: ERANT:	NO (LE	AD):		CENT WATER R-12 EXISTING		MASTER COMPRE CONDEN REFRIGI STATUS	SER: ERANT:	NO (LAG	1):		13 CENT WATER R-12 EXISTING	
PEAK DE	APTION:		308.8 744803	KW KWH/YR	CONFIG MAX LE LOAD L	URATION AD SETP	l: Cor PRO-	RATELO	AD:	PARALLS 80 100	į	CONFIG	URATION:				PARALLE NA 100	i i
DEMANG	COST:		\$47,123 \$17,875 \$64,998 \$188	/TONTYR	RATED	CAPACIT POWER: EFFICIEN				210.0 193.0 0.919	TONS KW	RATED	CAPACITY POWER: EFFICIEN				210.0 193.0 0.919	TONS KW KW/TON
PLANT	PLANT	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
LOAD	TONS	TONS	HR/YR	ĸw	TONS	%	%	%	ĸw	HR/YR	KWHYR	TONS	%	%	%	ĸw	HR/YR	KWHYR
15 3 3 1 3 1 3 1 1 3 1 1		0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 37 50 65 83 100 143 184 232 255 282 343 381 388 374 357 308 247 171 100 55 252 27 27 27 27 27 27 27 27 27 27 27 27 27	77.2 88.8 104.2 117.7 133.2 146.8 162.2 189.8 185.2 196.8 212.4 227.8 239.4 24.8 274.0 288.6	45.9 9.2 24.5 39.8 55.1 70.4 85.7 101.0 116.3 131.6 146.9 162.2 88.8 198.4 104.1 111.7 119.4 127.0 157.6 150.0 157.6 165.3 172.9 172.9	22 4 12 19 28 34 41 48 55 63 70 77 42 46 50 53 57 68 79 88 88 88 88 88 88 88 88 88 88 88 88 88	30 30 30 30 30 34 41 48 55 63 70 77 42 48 50 53 57 60 64 68 75 79 82 86	71 75	50.2 50.2 50.2 50.2 55.0 85.8 77.2 88.8 104.2 117.7 133.2 87.3 81.1 84.9 92.6 98.4 108.2 113.9 119.7 127.4 137.0 144.8	3212 5 20 41 72 108 143 184 232 259 292 343 381 398 374 357 308 247 7 109 5 7 7	161242 251 1004 2058 3614 5936 9381 14205 20602 29988 45688 25758 28440 30331 30309 28521 3186 959 290	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 0 0 0 0 0 0 0 0 0 0 0 0 42 46 53 53 57 60 64 68 87 1 75 79 82 88	68 71 75 79 82	0 0 0 0 0 0 0 0 0 0 0 35 38 42 44 44 48 51 55 59 82 86 75 80	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
			8602	2	i					7337	535070	1					2428	209733

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT NO BUILDING DESIGN L WINTER L SIMULATI	NO: OAD:	:	10 7051 158 15 EQ-1	TONS %DSGN	COMPRI CONDE	ISER: ERANT:	RNO (LE	AD):		CENT WATER R-11		COMPRI CONDEN REFRIGI	ESSOR: ISER: ERANT:	R NO (LA	3 1):		CENT WATER R-11	
PEAK DE	MAND:		121.0	KW	STATUS	2				EXISTING	3	STATUS					EXISTING	9
CONSUM	PTION:		303324	KWHYR		URATION		RATELO	AD-	SERIES//	CTIVE	CONFIG					SERIES/F	
DEMAND			\$18,465	ΛΉ	LOAD LI			MATERO	AD.	100	×	LOAD L		ч.			NA 100	%
ENERGY O			\$7,280 \$25,744	A/R	DATED (CAPACITY	<i>.</i> .			170.0	TONS I	RATED						
IO IAL GO	· · · · · · · · · · · · · · · · · · ·		425,744	,,,,	RATED					121.0	KW I	RATED		Y:			170.0 121.0	TONS KW
UNIT OUT	PUT COST:		\$151	/TON"YR	RATED	EFFICIEN	CY:			0.712	KW/TON		FFICIEN	CY:			0.712	KW/TON
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
*	TONS	TONS	HR/YR	ĸw	TONS	*	%	%	KW	HRYR	KWHYR	TONS	%	*	%	KW	HR/YR	KWHYR
15 W		0.0	4380	31.5	23.7	14	30	28	31.5	2044	84386		0	-		0.0	0	0
3 S 8 S	4.7 12.6	0.0 0.0	37 50	31.5 31.5	4.7 12.6	3	30	26 26	31.5 31.5		126		0	0		0.0	0	0
13 S	20.5	0.0	65	31.5	20.5	12	30	28	31.5	12 26	378 819		0	0		0.0	0	0
18 S	28.4	0.0	83	31.5	28.4	17	30	26	31.5	47	1481		ŏ	ŏ		0.0	,	0
23 S	38.3	0.0	106	31.5	36.3	21	30	26	31.5	74	2331		ŏ	ŏ		0.0	ő	ő
28 S	44.2	0.0	143	31.5	44.2	28	30	26	31.5	124	3906		Ó	ō		0.0	ő	ŏ
33 \$	52.1	0.0	184	32.7	52.1	31	31	27	32.7	184	6017		0	0		0.0	0	0
38 S 43 S	60.0 67.9	0.0	232 259	36.3	67.9	35	35	30	36.3	232	8422		0	0		0.0	0	0
48 S	75.8	0.0	292	46.0	75.8	45	45	34 38	41.1 46.0	259 292	10645		0	0		0.0	0	0
53 S	83.7	0.0	343	49.6	83.7	49	49	41	49.6	343	13432 17013		, o	0		0.0 0.0	0	0
58 S	91.6	0.0	381	54.5	91.6	54	54	45	54.5	381	20765		ő	ő		0.0	0	0
63 S	99.5	0.0	388	60.5	99.5	59	59	50	60.5	388	23474		ő	ő		0.0	ŏ	ŏ
68 S	107.4	0.0	374	65.3	107.4	63	63	54	65.3	374	24422		ŏ	ō		0.0	ŏ	ŏ
73 S	115.3	0.0	357	71.4	115.3	68	68	59	71.4	357	25490		0	0		0.0	ŏ	ō
78 S	123.2	0.0	308	76.2	123.2	72	72	63	76.2	308	23470		0	0		0.0	0	ó
83 S	131.1	0.0	247	83.5	131.1	77	77	69	83.5	247	20625		0	0		0.0	0	0
88 S 93 S	139.0 146.9	0.0 0.0	171	90.8	139.0	82	82	75	90.8	171	15527		0	0		0.0	0	0
98 S	154.8	0.0	109 59	96.8 (148.9	86	86 91	80	96.8	109	10551		0	0		0.0	0	0
103 S	162.7	0.0	25	112.5	154.8 162.7	96	98	86 93	104.1 112.5	59 25	6142 2813		0	0		0.0	0	0
108 S	170.6	0.6	7	121.0	170.0	100	100	100	121.0	7	847		0	0		0.0	0	0
113 S	178.5	8.5	2	121.0	170.0	100	100	100	121.0	,	242		ě	ŏ		0.0		0
118 S	186.4	16.4	ō	121.0	170.0	100	100	100	121.0	ō	0		ő	Ô		0.0	ō	0
			8602	!						6069	303324							

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

LANT N			13	!	MASTER	CHILLER	NO (LEA	D):		20	
BUILDING DESIGN WINTER SIMULAT	LOAD:		14020 154 0 EQ-1	TONS %DSGN	COMPRES CONDENS REFRIGE	SER:				CENT WATER R-113	
PEAK DE	MAND:		119.4 288530	KW KWHYR	STATUS: CONFIGU MAX LEAD	RATION:	au BRO "	ATE LO	n-	EXISTING SINGLE NA	*
DEMAND ENERGY			\$18,220 \$6,925	MR I	LOAD LIM	IT:	or PROP	TATE CO	ю.	100	~
TOTAL C	COST:		\$25,145 \$179	//R /	RATED CA RATED PO RATED EA	OWER:				140.4 119.4 0.850	TONS KW KW/TON
	TPUT COST:	PLANT	ANNUAL	PLANT	CHIL	*	*	- 	POWER	ANNUAL	ANNUAL
% PLANT DSGN LOAD	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT CAP ACT	RAT CAP ADJ	RAT		OCCUR ADJUST	ENERGY CONSUMP
*	TONS	TONS	HR/YR	kw	TONS	*	%	%	KW	HR/YR	KWHYR
0 1		0.0	4380	0.0	0.0	0	0 15	0 26	0.0 31.0	0 7	0 217
	S 4.8 S 12.3	0.0	37 60	31.0	12.3	9	15	26	31.0	30	930
13 :	S 20.0	0.0	65	31.0	20.0	14 20	15 20	26 26	31.0 31.0	61 83	1891 2573
	S 27.7 S 35.4	0.0	83 106	31.0 31.0	35.4	25	25	26	31.0	106	3286
28	S 43.1	0.0	143	32.2	43.1	31	31	27	32.2	143	4605
33	S 50.8	0.0	184 232	35.8 41.8	50.8 58.5	36 42	38 42	30 35	35.8 41.8	184 232	6587 9698
	S 58.5 S 66.2	0.0	232 259	45.6	66.2	47	47	39	46.6	259	12069
48	S 73.9	0.0	292	52.5	73.9	53	53	44	52.5	292	15330
	S 81.6 S 89.3	0.0	343 381	58.5 65.7	81.6	58 64	58 84	49 55	58.5 65.7	343 381	20068 25032
	S 97.0	0.0	388	71.6	97.0	69	69	60	71.6	388	27781
68	S 104.7	0.0	374	78.8	104.7	75	75	66	78.8	374 357	29471 30702
73	S 112.4 S 120.1	0.0	357 308	86.0 95.5	112.4 120.1	80 86	80 86	72 80	86.0 95.5	308	29414
	S 120.1 S 127.8	0.0	247	102.7	127.8	91	91	86	102.7	247	25367
8.8	\$ 135.5	0.0	171	113.4	135.5	97 100	97 100	95 100	113.4 119.4	171	19391 13015
	S 143.2 S 150.9	2.8 10.5	109 59	119.4 119.4	140.4 140.4	100	100	100	119.4	59	7045
103	S 158.6	18.2	25	119.4	140.4	100	100	100	119.4	25	2985
	S 166.3	25.9	7	119.4 119.4	140.4 140.4	100	100 100	100	119.4 119.4	7 2	836 239
	S 174.0 S 181.7	33.6 41.3	2 0	119.4	140.4	100	100	100	119.4	ō	0
			8602	Ì						4168	288530
PLANT I			14		MASTER	CHILLER	NO (LF	AD):		21	
BULDA	IG NO:		14023	Table						CENT	
DESIGN			168	TONS	COMPRE					CENT WATER	
SIMULA	TION MODEL	:	EQ-1		REFRIGE STATUS:	ERANT:				R-113 EXISTING	1
	EMAND: MPTION:		124.2 312200	KWH/YR	CONFIGI	URATION				SINGLE	
JU130	17016				MAXILEA	D SETPI		RATE LO	AD:	NA 100	% %
			\$18,953 \$7,493	AYR 1	LOAD LE	WIT:				100	76
	D COST:		\$26,446	ΛΉ	RATED (CAPACITY	Y:			146.0 124.2	TONS KW KW/TON
TOTAL	Y COST: COST:		2121	/TON'YR	RATED		CY:			0.851	
ENERG TOTAL UNIT OF	Y COST: COST: UTPUT COST:		\$181 ANNUAL	/TON'YR	RATED	EFFICIEN			POWER		ANNUAL
TOTAL	Y COST: COST:	PLANT LOAD SHED	\$181 ANNUAL OCCUR ACTUAL	PLANT DEMAND			RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ENERGY
ENERG TOTAL UNIT OF % PLANT DSGN	Y COST: COST: UTPUT COST: PLANT	PLANT LOAD	ANNUAL OCCUR ACTUAL HR/YR	PLANT DEMAND	RATED E	% RAT CAP ACT	% RAT CAP ADJ %	RAT POW	KW	ANNUAL OCCUR ADJUST HR/YR	ENERGY CONSUMP KWH/YR
ENERG TOTAL UNIT OF * PLANT DSGN LOAD	Y COST: COST: UTPUT COST: PLANT LOAD TONS W 0.0	PLANT LOAD SHED TONS	ANNUAL OCCUR ACTUAL HR/YR	PLANT DEMAND KW	CHE LOAD	% RAT CAP ACT	% RAT CAP ADJ %	POW	KW 0.0	ANNUAL OCCUR ADJUST	ENERGY CONSUMP KWH/YR
ENERG TOTAL UNIT OF % PLANT DSGN LOAD	Y COST: COST: UTPUT COST: PLANT LOAD	PLANT LOAD SHED TONS	ANNUAL OCCUR ACTUAL HR/YR	PLANT DEMAND KW	RATED E	# RAT CAP ACT	% RAT CAP ADJ % 0 15 15	% 	0.0 32.3 32.3	ANNUAL OCCUR ADJUST HR/YR 0 7 30	ENERGY CONSUMP KWH/YR
ENERG TOTAL UNIT OF % PLANT DSGN LOAD %	Y COST: COST: UTPUT COST: PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6	PLANT LOAD SHED TONS 0.0 0.0 0.0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65	PLANT DEMAND KW 0.0 32.3 32.3 32.3 32.3	TONS 0.0 5.0 13.3 21.6	% RAT CAP ACT %	% RAT CAP ADJ % 0 15 15 15 15	% 	0.0 32.3 32.3 32.3 32.3	ANNUAL OCCUR ADJUST HR/YR 0 7 30 65	ENERGY CONSUMP KWH/YR 22/ 96/ 210/
ENERG TOTAL UNIT OF % PLANT DSGN LOAD %	Y COST: COST: UTPUT COST: PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 22.9	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83	PLANT DEMAND KW 0.0 32.3 32.3 32.3 32.3 32.3	CHL LOAD TONS 0.0 5.0 13.3 21.6 29.9	RAT CAP ACT %	% RAT CAP ADJ % 0 15 15 15 20	% 	0.0 32.3 32.3 32.3 32.3	ANNUAL OCCUR ADJUST HR/YR 0 7 30	ENERGY CONSUMP KWH/YR 222 96: 2100 268 342:
ENERG TOTAL UNIT OF MANT DSGN LOAD 0 3 8 13 13 18 28	Y COST: COST: UTPUT COST: PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 46.5 S 46.5	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 143	PLANT DEMAND 0.0 32.3 32.3 32.3 32.3 32.3 32.3 32.3	CHE LOAD 10.0 5.0 13.3 21.6 29.9 38.2 46.5 46.5	% RAT CAP ACT % 9 15 20 28 32	% RAT CAP ADJ % 0 15 15 15 15 20 28 32	% 	0.0 32.3 32.3 32.3 32.3 32.3 32.3 32.3	ANNUAL OCCUR ADJUST HR/YR 0 7 30 65 83 106 143	ENERGY CONSUMP KWH/YR 22: 98: 210: 288: 342: 479
ENERG TOTAL UNIT OF % PLANT DSGN LOAD % 0 3 8 13 18 23 28 23 33	Y COST: COST: UTPUT COST: PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 48.5 S 54.8	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106 143 184	PLANT DEMAND KW 0.0 32.3 32.3 32.3 32.3 32.3 32.3 32.3	CHE LOAD 10.0 5.0 13.3 21.6 29.9 38.2 46.5 54.8	% RAT CAP ACT % 0 3 9 15 20 26 32 38	% RAT CAP ADJ % 0 15 15 15 20 28 32 38	% 0 26 26 26 26 26 27 32	0.0 32.3 32.3 32.3 32.3 32.3 32.3 32.3 3	ANNUAL OCCUR ADJUST HR/YR 0 7 30 65 83 106 143 184	ENERGY CONSUMP KWH/YR 224 964 2100 288 3424 479 7309
ENERG TOTAL UNIT OF PLANT DSGN LOAD 3 3 13 18 23 28 33 38	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 46.8 S 63.1 S 71.4	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106 143 184 232 259	PLANT DEMAND KW 0.0 32.3 32.3 32.3 32.3 32.3 32.3 42.7 44.7 50.9	TONS TONS 1 0.0 1 5.0 1 13.3 21.6 29.9 38.2 46.5 46.5 54.8 63.1 71.4	% RAT CAP ACT % 9 15 20 38 32 38 49	% RAT CAP ADJ % 0 15 15 15 20 28 32 38 44 44	RAT POW % 0 26 28 28 26 26 27 32 36 41	0.0 32.3 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 106 85 83 1184 232 259	ENERGY CONSUMP KWH/YR 22(2) 963 2100 288: 3424 479 7300 10370
ENERG TOTAL UNIT OF PLANT DSGN LOAD 0 3 8 13 18 23 28 33 38 44	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 46.8 S 63.1 S 71.4	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 108 143 184 232 259 292	PLANT DEMAND .00 32:3 32:3 32:3 32:3 32:3 32:3 33:5 39:7 44:7 50:9 57:1	CHL LOAD TONS 0.0 13.3 22.9 38.2 24.5 54.8 63.1 71.4 79.7	% RAT CAP ACT % 0 3 9 15 20 28 32 38 43 49 55	% RAT CAP ADJ % 15 15 15 20 32 38 43 43 45 55	% 0 26 28 26 26 26 27 32 36 4 41 46	0.0 32.3 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 57.1	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 108 143 184 232 259 292	ENERGY CONSUMP KWH/YR 224 986 2100 268 3424 479 7301 10371 1318:
ENERG TOTAL UNIT OF PLANT DSGN LOAD	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 21.8 S 21.8 S 29.9 S 38.2 S 46.5 S 54.8 S 54.8 S 55.4 S 571.4 S 70.7 S 79.7 S 88.0	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ANNUAL OCGUR ACTUAL HR/YR 4380 37 50 85 83 108 143 184 232 259 292 343	PLANT DEMAND 0.0 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 57.1 63.3	CHL LOAD 10.0 1	% RAT CAP ACT % 0 3 9 15 20 28 32 38 43 49 55 60	% RAT CAP ADJ % 0 15 15 15 20 28 32 38 43 49 5 56 60	% 0 26 28 26 26 26 27 32 36 41 46 51	0.0 32.3 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 106 85 83 1184 232 259	ENERGY CONSUMP KWH/YR 22(98) 2100 288: 342: 479 730: 1037* 1318: 1887: 2171: 2897:
ENERG TOTAL UNIT OF PLANT DSGN LOAD 0 3 8 13 18 23 28 33 38 44	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 21.6 S 21.6 S 21.6 S 5.4 S 5.4 S 5.4 S 5.5 S 5.4 S 5.5 S 5.0 S 5	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 108 149 184 232 259 292 343 381 388	0.0 92.3 92.3 92.3 92.3 92.3 92.3 93.5 99.7 44.7 50.9 57.1 83.2 70.8	CHL LOAD 10.0 1	% RAT CAP ACT % 0 3 9 9 15 120 28 32 38 43 49 55 80 68 72	% RAT CAP ADJ % 0 155 15 20 28 32 38 43 49 55 60 66 672	RAT POW % 0 26 26 26 26 26 26 26 26 27 32 36 41 146 51 63	KW 0.0 32.3 32.3 32.3 32.3 32.5 39.7 44.7 50.9 57.1 63.3 70.8 78.2	ANNUAL OCCUR ADJUST HRYR 0 7 7 30 65 65 83 108 143 124 222 259 2943 381 388	ENERGY CONSUMP KWH/YR (226 96 2100 2888 3424 479 73003 1037 1318 1867 21711 2897
ENERG TOTAL UNIT OF % PLANT DSGN LOAD 0 3 8 8 13 13 18 23 28 28 33 34 34 43 45 56 63 65 65 65	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 21.6 S 29.9 S 38.2 S 46.5 S 54.8 S 63.1 S 71.4 S 70.7 S 88.0 S 96.3 S 104.8 S 104.8 S 104.8	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106 143 184 232 259 292 343 381 388	PLANT DEMAND 0.0 22.3 32.3 32.3 32.3 32.5 39.7 44.7 50.9 57.1 63.2 70.8 78.2	RATED E CHL LOAD 10.0 5.0 11.2 29.9 38.2 46.5 54.8 63.1 71.4 79.7 89.0 99.3 104.6 112.9	% RAT CAP ACT % 0 3 9 15 20 26 32 38 43 49 55 66 67 77 77 77 77 77 77 77 77 77 77 77	% RAT CAP ADJ % 0 15 15 15 20 28 32 34 49 55 60 66 777	% 0 26 26 26 26 26 26 26 27 32 36 41 46 51 57 63 69	0.0 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 57.1 63.3 70.8 78.2 85.7	ANNUAL OCCUR ADJUST HR/YR 0 7 7 30 0 85 83 106 144 1232 225 225 243 381 388 374 45 378	ENERGY CONSUMP KWH/YR (221 966 2100 288 342 479 7300 1037 1318 1667 21711 2897 3034 3205
ENERG TOTAL UNIT OF TOTAL UNIT	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 21.6 S 10.4 S 5.4 S 5.4	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 114 1184 222 259 2402 341 348 347 348 357	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 92.3 92.7 44.7 50.9 57.1 83.3 70.8 78.2 85.7	CHL LOAD 10.0 5.0 13.3 21.6 22.9 38.2 46.5 54.8 63.1 71.4 77.7 88.0 99.3 104.6 112.9 121.2	% RAT CAP ACT % 0 3 9 9 15 120 28 32 38 43 49 55 80 68 72	% RAT CAP ADJ % 0 155 15 20 28 32 38 43 49 55 60 66 672	RAT POW % 0 26 28 28 28 28 28 29 36 41 48 51 67 63 69 788	0.0 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 57.1 83.3 70.8 78.2 85.7 94.4 103.1	ANNUAL OCCUR ADJUST HR/YR 0 7 7 30 0 85 83 108 108 144 1232 2559 292 343 381 388 374 357 308	ENERGY CONSUMP KWH/YR (221 2966 2100 288 3422 479 7300 1037 13188 1867; 21711 21897 3205; 3370 31757
ENERG TOTAL UNIT O' UN	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 29.9 S 38.2 S 46.5 S 46.5 S 46.5 S 46.5 S 46.5 S 46.5 S 46.5 S 104.8 S 104.8 S 112.9 S 112.9	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 108 1434 222 229 243 381 388 374 387 308	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 92.3 93.5 99.7 44.7 50.9 57.1 83.3 70.8 70.8 70.8 71.8 71.8 71.8 71.8 71.8 71.8 71.8 71	CHL LOAD 1 0.0 15.0 19.2 19.3 19.3 19.3 19.3 19.3 19.3 19.3 19.3	% RAT CAP ACT % 0 3 9 1 15 20 26 32 38 43 49 55 60 68 72 77 77 83 89 99 99 99	% RAT CAP ADJ % 0 15 15 15 20 28 32 38 49 55 60 66 72 77 78 3 89 99	RAT POW % 0 26 26 26 26 26 27 32 36 41 46 57 63 69 76 83 90	0.0 32.3 32.3 32.3 32.3 32.5 32.7 44.7 50.9 67.1 83.3 70.8 78.2 85.7 94.4 103.1 111.8	ANNUAL OCCUR ADJUST HR/YR 0 7 7 30 65 83 3 106 1443 1344 232 259 292 259 343 388 374 357 308 247	ENERGY CONSUMP KWHVYR 222 96: 2100 288 3422 479 7300 1037 1318: 1867 2171 2807 3024 3205 3370 3175 2761
ENERG TOTAL UNIT 01 %	Y COST: COST: PLANT LOAD TONS W 0.0 S 5.0 S 21.8 S 29.9 S 38.2 S 46.5 S 54.8 S 54.8 S 54.8 S 54.8 S 51.2 S 112.9 S 112.9	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 143 144 232 259 202 343 381 389 374 357 308 247	PLANT DEMAND 0.0 922 322 323 323 323 323 33.7 44.7 50.9 57.1 633 70.8 78.2 85.7 94.4 103.1 111.8 124.2	CHL LOAD 10.0 1	% RAT CAP ACT % 0 3 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	% RAT CAP ADJ 0 155 15 20 28 32 34 49 55 80 66 672 777 83 89 940	RAT POW % 26 28 28 28 28 26 25 36 41 46 51 57 83 89 76 83 990 100	0.0 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 67.1 83.3 70.8 70.8 70.8 111.8	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 108 1144 2232 2559 292 3443 381 388 374 3574 3574 3574 3575 308 2477 1711	ENERGY CONSUMP KWHVR 2210 2100 2888 288 2424 479 7300 1037 1318 1687 2171 1289 7300 30370 30372 751 2751 2751 2751 2751 2751 2751 275
ENERGI TOTAL UNIT O' U	Y COST: COST: UTPUT COST. PLANT LOAD W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 29.9 S 46.5 S 54.8 S 63.1 S 71.4 S 79.7 S 84.0 S 104.8 S 112.9 S 121.2 S 121.2 S 121.2 S 121.2 S 121.2 S 121.3 S 121.3 S 121.4 S 121.5 S 121.5	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 108 1434 222 229 243 381 388 374 387 308	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 92.3 93.5 99.7 44.7 50.9 57.1 63.3 70.8 70.8 71.8 71.8 71.8 71.8 71.8 71.8 71.8 71	CHL LOAD 1 0.0 15.0 19.2 19.3 19.3 19.3 19.3 19.3 19.3 19.3 19.3	% RAT CAP ACT % 0 15 20 26 32 38 43 49 55 50 60 66 72 77 73 89 94 100 100 100 100	% RAT CAP ADJ % 0 155 15 15 20 20 28 32 38 43 49 55 80 66 672 777 83 89 94 100 100 100 100 100 100 100 100 100 10	RAT POW % 26 28 28 26 26 26 27 32 36 45 51 57 63 69 90 100 100 100 100 100	0.0 32.3 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 67.1 63.3 70.8 85.7 94.4 103.1 111.8 124.2 124.2 124.2	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 31 106 143 124 222 259 292 343 381 388 374 357 308 247 1711 100 50	ENERGY CONSUMP (CONSUMP) (
BNERG TOTAL UNIT O' % UNIT O' % NO 0 0 3 8 8 23 32 88 83 84 84 83 84 84 85 86 84 85 86 86 86 86 86 86 86 86 86 86 86 86 86	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 29.9 S 38.2 S 79.7 S 63.1 S 71.4 S 79.7 S 83.0 S 112.9 S 5 112	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 1434 222 259 243 3811 381 381 381 381 381 381 381 381 3	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 92.3 93.5 90.7 44.7 50.9 57.1 63.3 70.8 78.2 85.7 94.4 103.1 113.1 124.2 124.2 124.2 124.2 124.2	CHL LOAD 10.0 15.0	% RAT CAP ACT % 0 15 20 28 32 32 32 34 34 43 45 55 60 66 727 73 83 89 94 100 100 100 100 100 100 100 100 100 10	% RAT CAP ADJ % 0 155 155 155 200 28 32 38 49 556 66 772 777 83 89 94 1000 1000 1000 1000 1000 1000 1000	RAT POW % 0 26 28 28 28 28 26 27 32 36 41 48 51 57 63 99 76 83 99 100 100 100 100 100 100 100 100 100	0.0 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 57.1 83.3 70.8 85.7 94.4 103.1 111.8 124.2 124.2 124.2	ANNUAL OCCUR ADJUST HRYYR 0 7 7 30 65 83 3106 1443 1244 222 259 2092 2943 3981 3744 3577 308 2477 1711 1000 50 255	ENERGY CONSUMP (CONSUMP) (
ENERG TOTAL UNIT OF 10 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1 A 1	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 10.4 S 21.8 S 21.8 S 21.8 S 38.2 S 38.2 S 38.2 S 38.2 S 104.8 S 71.4 S 79.7 S 88.0 S 98.3 S 104.8 S 110.4 S 112.9 S 121.2 S 129.5 S 154.4 S 71.4 S 1154.4 S 1154.4 S 1154.4 S 1154.7 S 1162.7 S 1171.0 S 1771.0	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 106 143 184 232 259 202 343 381 388 374 308 247 171 109 59 25 7	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 93.5,7 44.7 50.9 57.1 83.3 70.8 78.2 85.7 94.4 103.1 111.8 124.2 124.2 124.2 124.2	CHL LOAD 10.0 1	% RAT CAP ACT % 9 15 5 5 5 5 5 5 5 5 5 6 6 6 6 6 6 6 6 6	% RAT CAP ADJ % 0 15 15 15 15 20 28 8 43 49 55 60 66 672 777 83 89 94 100 100 100 100 100 100 100 100 100 10	RAT POW % 26 28 28 26 26 26 27 32 36 45 51 57 63 69 90 100 100 100 100 100	0.0 32.3 32.3 32.3 32.3 32.3 32.3 33.5 39.7 44.7 50.9 67.1 63.3 70.8 85.7 94.4 103.1 111.8 124.2 124.2 124.2	ANNUAL OCCUR ADJUST HR/YR 0 7 30 85 83 31 106 143 124 222 259 292 343 381 388 374 357 308 247 1711 100 50	ENERGY CONSUMP KWHYR 222 966 2100 2888 3424 4797 7300 10377 1318 1867 2171 28977 3034 3205 2761 2123 2135 3 732 2161 888 244 248 248 248 248 248 248 248 248
BNERG TOTAL UNIT O' % UNIT O' % NO 0 0 3 8 8 23 32 88 83 84 84 83 84 84 85 86 84 85 86 86 86 86 86 86 86 86 86 86 86 86 86	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 29.9 S 38.2 S 79.7 S 63.1 S 71.4 S 79.7 S 83.0 S 112.9 S 5 112	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 1434 222 259 243 3811 381 381 381 381 381 381 381 381 3	PLANT DEMAND 0.0 92.3 92.3 92.3 92.3 92.3 93.5 90.7 44.7 50.9 57.1 63.3 70.8 78.2 85.7 94.4 103.1 113.1 124.2 124.2 124.2 124.2 124.2	CHL LOAD 10.0 15.0	% RAT CAP ACT % 0 15 20 28 32 32 32 34 34 43 45 55 60 66 727 73 83 89 94 100 100 100 100 100 100 100 100 100 10	% RAT CAP ADJ % 0 155 155 155 200 28 32 38 49 556 66 772 777 83 89 94 1000 1000 1000 1000 1000 1000 1000	RAT POW % 0 26 28 26 26 26 27 32 36 41 46 51 57 63 89 76 83 900 100 100 100 100 100 100 100 100 100	0.0 32.3 32.3 32.3 32.3 32.3 32.5 30.7 44.7 50.9 57.1 83.3 70.8 78.2 85.7 94.4 103.1 111.8 124.2 124.2 124.2 124.2	ANNUAL OCCUR ADJUST HRYYR 0 7 30 65 83 3106 144 232 259 292 343 381 388 377 357 77 171 109 50 25 77	ENERGY CONSUMP (CONSUMP) (
BNERG TOTAL UNIT OI	Y COST: COST: UTPUT COST. PLANT LOAD TONS W 0.0 S 5.0 S 13.3 S 21.6 S 29.9 S 38.2 S 29.9 S 38.2 S 79.7 S 63.1 S 71.4 S 79.7 S 83.0 S 112.2 S 12.2 S 12.2 S 12.3 S 12.4 S 1	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 108 1434 1844 232 259 242 259 343 381 381 381 381 381 381 387 7 308 247 171 109 59 255 7	PLANT DEMAND 0.0 32.3 32.3 32.3 32.3 32.5 39.7 44.7 50.9 57.1 63.3 78.2 85.7 94.4 101.18 111.8 124.2 124.2 124.2 124.2	CHL ### CAP PROPERTY OF THE PROPER	% RAT CAPP 0 15 15 15 15 15 15 15 15 15 15 15 15 15	RAT POW % 26 28 28 28 28 28 28 28 38 41 48 51 67 63 89 78 83 90 100 100 100 100 100 100 100	KW 0.0 32.3 32.3 32.3 32.3 33.5 744.7 50.9 67.1 83.3 70.8 78.2 124	ANNUAL OCCUR ADJUST HRYYR 0 7 30 65 83 106 1443 1242 2259 222 343 381 388 3757 308 247 171 1000 50 25 7 7 2 2	ENERGY CONSUMP KWHYR 222 966 2100 2888 3424 4797 7300 10377 1318 1867 2171 28977 3034 3205 2761 2123 2135 3 732 2161 888 244 248 248 248 248 248 248 248 248	

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT NO: BUILDING NO:		15 21002		MASTER	CHILLER	NO (LE	AD):		22	
DESIGN LOAD: WINTER LOAD: SIMULATION MODEL:		240 240 0 EQ-1	tons %Dsgn	COMPRE	SER:				CENT WATER R-12	
PEAK DEMAND:		188.0		STATUS					EXIST	
CONSUMPTION: DEMAND COST:		463061 \$28,689	KWH/YR /YR	CONFIGI MAX LEA LOAD LE	D SETP1		RATELO	AD:	SINOLE NA 100	*
ENERGY COST: TOTAL COST:		\$11,113 \$39,802	A/R	RATED C	APACIT	Y :			215.0 188.0	TONS KW
UNIT OUTPUT COST:		\$185	/TONTYR	RATED		CY:			0.874	KW/TON
% PLANT PLANT LOAD DSGN LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
% TONS	TONS	HR/YR	ĸw	TONS	*	*	*	KW	HRYR	KWHYR
0 W 0.0 3 S 72	0.0	4380 37	0.0 48.9	0.0 7.2	0	0 15	0 26	0.0 48.9	0 7	34
8 S 19.2 13 S 31.2	0.0	50 65	48.9 48.9	19.2 31.2	9 15	15 16	26 26	48.9	30 65	1467 3179
18 S 43.2	0.0	83	48.9	43.2	20	20	26	48.9	83	4059
23 S 55.2 28 S 67.2	0.0	106	48.9	55.2	26 31	26	26	48.9	106	5183
33 S 79.2	0.0	143 184	50.8 58.3	67.2 79.2	37	31 37	27 31	50.8 58.3	143 184	7264 10727
38 S 91.2	0.0	232	65.8	91.2	42	42	35	65.8	232	15266
43 S 103.2 48 S 115.2	0.0	259 292	75.2 84.8	103.2 115.2	48 54	48 54	40	75.2 84.6	259 292	19477 24703
53 \$ 127.2	0.0	343	94.0	127.2	59	59	50	94.0	343	32242
58 S 139,2	0.0	381	105.3	139.2	85	65	58	105.3	381	40119
63 S 151.2 68 S 163.2	0.0	388 374	114.7 127.8	151.2 163.2	70 76	70 76	61 68	114.7 127.8	388 374	44504 47797
73 S 175.2	0.0	357	139.1	175.2	81	81	74	139.1	357	49859
78 S 187.2 83 S 199.2	0.0	308 247	152.3 (167.3)	187.2 199.2	87 93	87 93	81 89	152.3 167.3	308 247	46908 41323
88 5 211.2	0.0	171	180.5	211.2	98	98	96	180.5	171	30866
93 S 223.2 98 S 235.2	8.2 20.2	109 59	188.0 188.0	215.0 215.0	100 100	100 100	100	188.0 188.0	109	20492
103 S 247.2	32.2	25	188.0	215.0	100	100	100	188.0	25	4700
108 S 259.2 113 S 271.2	44.2 58.2	7	188.0	215.0	100	100	100	188.0	7	1316
113 S 271.2 118 S 283.2	58.2 68.2	0	188.0 188.0	215.0 215.0	100	100	100	188.0 188.0	0	376
		8602							4172	463061
BUILDING NO:		16 27004		MASTER		NO (LE	AD):		23	
BUILDING NO: DESIGN LOAD:		27004 488	TONS	COMPRE	SSOR:	NO (LE	AD):		CENT	• *************************************
BUILDING NO: DESIGN LOAD: WINTER LOAD:		27004	TONS		SSOR: SER: FRANT:	NO (LE	AD):			-
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND:	-	27004 488 0		COMPRE CONDEN REFRIGE STATUS:	SSOR: SER: ERANT:	t.			CENT WATER R-12 EXISTING	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION:		27004 488 0 EQ-1	%DSGN KW	COMPRE CONDEN REFRIGE STATUS:	SSOR: ISER: ERANT: JRATION D SETPI	t.)AD:	CENT WATER R-12 EXISTING	3 % %
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: BNERGY COST:		27004 488 0 EQ-1 408.0 936039 \$62,261 \$22,465	*DSGN KW KWHVYR /YR /YR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIN	SSOR: SER: ERANT: JRATION D SETPT	t or PRO-		AD:	CENT WATER R-12 EXISTING SINGLE NA 100	% %
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST:	-	27004 488 0 EQ-1 408.0 936039 \$62,261	*DSGN KW KWHYR	COMPRE CONDEN REFRIGE STATUS: CONFIGURAL	SSOR: SER: ERANT: JRATION D SETPT MIT: CAPACITY FOWER:	: or PRO- /:		AD:	CENT WATER R-12 EXISTING SINGLE NA	%
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST:	PLANT	27004 488 0 EQ-1 408.0 936039 \$62,261 \$22,465 \$84,726	*LDSGN KW KWHVR VR VR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIN RATED C RATED F	SSOR: SER: ERANT: JRATION D SETPT MIT: CAPACITY FOWER:	: f or PRO- y: CY:	RATE LO		CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877	% % TONS
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: DEMAND COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: % PLANT PLANT LOAD DSSAN		27004 488 0 EQ-1 408.0 938039 \$62,261 \$22,485 \$84,726 \$182	KW KWHVA AR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIB RATED C RATED C	SSOR: SER: ERANT: JRATION D SETPT MIT: CAPACITY OWER: EFFICIEN:	: or PRO- /:		POWER	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0	TONS KW KW/TON ANNUAL ENERGY
BULDING NO: DESIGN LOAD: WINTER	PLANT LOAD	27004 488 0 EQ-1 408.0 938039 \$62,261 \$22,485 \$84,726 \$182 ANNUAL OCCUR	*LDSQN KW KWHVR //R //R //R //TON"YR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LE RATED C RATED F RATED E	SSOR: SER: SERANT: JRATION D SETPT AIT: CAPACITY COWER: FFICIEN:	CY:	RATE LO		CENT WATER R-12 EXISTING SINGLE NA 100 465.0 408.0 0.877 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAX DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: W PLANT PLANT LOAD DOSON LOAD 0 W 0.0	PLANT LOAD SHED TONS	27004 488 0 EQ-11 408.0 \$38039 \$62,261 \$22,465 \$84,726 \$182 ANNUAL OCCUR ACTUAL HR/YR	*LDSGN KW KWHYYR YR YR YR YR YR YR PLANT DEMAND KW 0.0	COMPRESCONDEN REFRIGE STATUS: CONFIGURA LOAD LB RATED O RATED	SSOR: SER: SERANT: URATION D SETPT AIT: OWER: SEFFICIEN RAT CAP ACT	CY: RAT CAP ADJ	RATE LO	POWER	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP
BULDING NO: DESIGN LOAD: WINTER LOAD: DEMAND COST: BHERGY COST: TOTAL COST: UNIT OUTPUT COST: WINTER LOAD DEGAN LOAD USGN TONS	PLANT LOAD SHED TONS	27004 488 0 EQ-1 408.0 938939 \$62,261 \$22,485 \$84,726 \$192 ANNUAL OCCUR ACTUAL	KW KWHYR YR Y	COMPRES CONDEN REFRIGE STATUS: CONFIGURA LEA LOAD LB RATED GRATED FRATED ECHL LOAD TONS 0.0 0.14.8	SSOR: SER: SERANT: JRATION D SETPT MIT: CAPACITY OWER: FFFICIEN RAT CAP ACT	% O 15	RATE LO	POWER KW 0.0 106.1	CENT WATER R-12 EXISTING SINGLE NA 100 465.0 405.0 408.77 ANNUAL OCCUR ADJUST HRAYR 0 7	TONS KW KW/TON ANNUAL ENERGY CONSUMP
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BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAX DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: UNIT OUTPUT COST: VA PLANT LOAD DESON LOAD V 0.0 3 S 14.8 8 S 34.9 13 S 85.2 13 S 87.5 23 S 111.8 28 S 136.1 33 S 180.4 34 S 203.0 38 S 14.8 38 S 28.9 39 S 13.8 38 S 28.9 39 S 13.8 39 S 13.8 30 S 180.4 31 S 203.0 32 S 111.8 35 S 281.9 36 S 300.5 37 S 354.8 37 S 330.5 38 S 330.5	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	27004 488 0 EQ-1 408.0 \$050039 \$62,261 \$22,465 \$84,726 \$192 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 85 83 108 443 1184 222 259 292 243 381 388 374 357 308 247	*DSGN KW KWH/YR /YR /YR /YR /YR /TON'YR PLANT DEMAND KW 0.0 106.1 106	COMPRES CONDENS CONDENS CONFIGURATIONS CONFIGURATION CONFI	ISSOR: ISER: IFRANT: IFRANTON D SETPI MIT: IFRANTON OWER: IFRANTON WER:	CY: % RAT I CAP ADJ 0 15 15 15 15 15 15 15 15 15 15 15 15 15	% RATE LO % RAT POW % 0 26 8 28 26 29 34 34 34 46 52 57 62 875 62 875 81	0.0 106.1 106.1 106.1 106.1 118.3 139.7 155.0 171.4 197.7 212.2 232.8 253.0 277.4 306.0 330.5	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877 ANNUAL OCCUR ADJUST HR/YR 0 7 27 61 83 106 143 212 259 269 269 243 381 388 374 357 308	% % TONS KW KWTON ANNUAL ENERGY CONSUMP KWHY'R 2886 8472 11247 15172 2176 32176 40144 94822 94244 94822 94244 9424 9424 942
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BULDING NO: DESIGN LOAD: SIMULATION MODEL: PRACTION MODEL: PERK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: UNIT OUTPUT COST: 10 W 0.0 3 S 14.8 8 S 24.9 13 S 85.2 18 S 87.5 23 S 111.8 28 S 138.1 28 S 138.1 39 S 85.2 31 11.8 28 S 138.1 39 S 85.2 31 11.8 28 S 138.1 39 S 85.2 30 S 184.7 30 S 85.2 30 S 184.7 31 S 85.2 31 S 184.7 32 S 17.8 33 S 184.7 34 S 233.3 35 S 184.7 36 S 379.1 37 S 379.1 38 S 463.4 38 S 467.7 39 S 452.0 38 S 478.3 103 S 500.8	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	27004 488 0 EQ-1 408.0 \$28039 \$62,261 \$22,465 \$84,726 \$182 ANNUAL OCCUR ACTUAL HRIYR 4380 37 50 85 83 108 144 222 259 202 202 343 381 381 374 357 308 247 171 109 59 25 7	*DSGN KW KWHYR YR YR YR TONTYR PLANT DEMAND 106.1	COMPRECONDENS CONDENS CONFIGURA MAX LEA LOAD LI RATED O RATED F RATED E CHL LOAD TONS 0.0 14.6 38.9 63.2 97.5 111.8 138.1 138.1 138.1 138.1 138.1 138.1 149.7 209.0 233.3 257.8 281.9 308.2 305.3 354.8 379.1 403.4 427.7 452.0 485.0	SSOR: SSER:	" or PRO- " CCY: " RAT CAP ADJ " 44 40 45 50 61 68 71 78 82 97 92 97 100 100	% RATE LO % RAT POW % 0 26 8 28 28 28 28 29 34 34 22 68 52 75 81 83 95 100 100 100 100 100 100 100 100 100 10	0.0 108.1 108.1 108.1 108.1 108.1 108.1 108.1 108.1 108.2 232.8 253.0 277.4 306.0 330.5 330.5 330.5 340.8.0 408.0 408.0	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877 ANNUAL OCCUR ADJUST HRAYR 0 7 27 61 83 31 108 144 222 229 223 341 348 374 357 308 247 171 109 59 25 7	% % TONS KW KWTON ANNUAL ENERGY CONSUMP KWHYR 2885 8477 32176 32176 3044 5044 5044 64381 8084 4024 64381 64381 8084 4024 6424 61388 4224 61388 61388 6138 6138 6138 6138 6138 61
BULDING NO: DESIGN LOAD: BSIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAX DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: W PLANT LOAD TONS TONS W 0.0 3 \$ 14.8 8 \$ 34.9 13 \$ 83.2 13 \$ 83.2 13 \$ 83.2 13 \$ 136.1 33 \$ 136.1 33 \$ 136.1 33 \$ 136.1 33 \$ 136.1 34 \$ 239.3 35 \$ 127.8 36 \$ 231.9 37 \$ 308.2 38 \$ 138.7 39 \$ 308.2 39 \$ 257.8 30 \$ 257.8 31 \$ 308.2	PLANT LOAD SHED TONS	27004 488 0 EQ-1 408.0 938039 \$62,261 \$22,465 \$34,726 \$192 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106 144 1344 222 259 2443 381 381 384 374 377 308 247 171 109 59 25 7	*DSGN KW KWH/YR /YR /YR /YR /YR /TON'YR PLANT DEMAND KW 0.0 106.1 106	COMPRECONDENT CONFIGURATION CO	SSOR: SER. SER. SER. SER. SER. SER. SER. SER.	CY: % RAT 1 % ADJ % ADJ 15 15 15 15 17 86 71 78 82 92 71 100 100 100	% RATE LO % RAT POW % 0 0 26 28 28 28 29 34 34 34 34 34 34 34 35 25 75 65 86 75 81 88 95 100 100 100 100 100 100 100 100 100 10	POWER KW 0.00 106.1 106.1 106.1 106.1 118.3 139.7 155.0 171.4 187.7 223.8 253.0 277.4 308.0 387.8 408.0 408.0 408.0	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877 ANNUAL OCCUR ADJUST HRAYR 0 7 7 61 83 106 143 184 222 229 222 343 381 184 357 308 347 171 109 59 57 7 2	% % TONS KW KWTON ANNUAL ENERGY CONSUMP KWH-V'R 74.2888 847; 8800 1124:1517; 2176:3217:4014:5004:438189924:4489224990339424:2407; 10200 2855:8116
BULDING NO: DESIGN LOAD: BUSING LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAX DEMAND: CONSUMPTION: DEMAND COST: DEMAND COST: UNIT OUTPUT COST: UNIT OUTPUT COST: UNIT OUTPUT LOAD \$ TONS 0 W 0.0 3 S 14.8 8 S 24.9 13 S 83.2 18 S 87.5 23 S 111.8 28 S 138.1 39 S 184.7 39 S 30.5 73 S 30.5 73 S 30.5 73 S 379.1 83 S 403.4 83 S 427.7 93 S 452.0 98 S 478.3 103 S 500.8 103 S 500.8	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	27004 488 0 EQ-1 408.0 \$28039 \$62,261 \$22,465 \$84,726 \$182 ANNUAL OCCUR ACTUAL HRIYR 4380 37 50 85 83 108 144 222 259 202 202 343 381 381 374 357 308 247 171 109 59 25 7	*DSGN KW KWHYR YR YR YR TONTYR PLANT DEMAND 106.1	COMPRECONDENS CONDENS CONFIGURA MAX LEA LOAD LI RATED O RATED F RATED E CHL LOAD TONS 0.0 14.6 38.9 63.2 97.5 111.8 138.1 138.1 138.1 138.1 138.1 138.1 149.7 209.0 233.3 257.8 281.9 308.2 305.3 354.8 379.1 403.4 427.7 452.0 485.0	SSOR: SSER:	" or PRO- " CCY: " RAT CAP ADJ " 44 40 45 50 61 68 71 78 82 97 92 97 100 100	% RATE LO % RAT POW % 0 26 8 28 28 28 28 29 34 34 22 68 52 75 81 83 95 100 100 100 100 100 100 100 100 100 10	0.0 108.1 108.1 108.1 108.1 108.1 108.1 108.1 108.1 108.2 232.8 253.0 277.4 306.0 330.5 330.5 330.5 340.8.0 408.0 408.0	CENT WATER R-12 EXISTING SINGLE NA 100 485.0 408.0 0.877 ANNUAL OCCUR ADJUST HRAYR 0 7 27 61 83 31 108 144 222 229 223 341 348 374 357 308 247 171 109 59 25 7	% % TONS KW KWTON ANNUAL ENERGY CONSUMP KWHYR 2886 847.7 8800 1124 15172 2176 32176 40144 50044 64381 843818

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

RANT CAMP																		
MACHINISH MACH	BUILDING NO: DESIGN LOAD: WINTER LOAD:	:	28000 238 0		COMPRE CONDEN REFRIGI	SSOR: ISER: ERANT:	i no (Le	ND):		WATER R-12	, 1 1	COMPRE	SSOR: ISER: ERANT:	I NO (LAC	3 1):		WATER R-12	
MATERIORIS 18,000 70	CONSUMPTION:		400315	KWHYR	CONFIGI MAX LEA	URATION D SETPT		RATE LO	AD:	PARALLE 80	· , i	CONFIGI MIN LAG	JRATION: SETPON				PARALLE NA	· .
PART CAST	ENERGY COST: TOTAL COST:		\$35,550	MR I	RATED F	OWER:				85.0	KW I	RATED F	OWER:				¥5.0	kw j
PANT CAN									POWER			CHIL	~	~		POWER	ANNUAL	ANNUAL I
0 W 0.1 0.0 4255 0.2 1 0.0 1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	PLANT LOAD DSGN	LOAD	OCCUR			RAT	RAT	RAT		OCCUR	ENERGY	LOAD	CAP	CAP	RAT		ADJUST	CONSUMP
\$ 9 71	% TONS	TONS	HR/YR	kw i	TONS	*	*	_ *	KW	HRYR	KWHYR I	TONS	<u>*</u>	<u>*</u>	*		HRYR	KWHYR
PLANT INC 18	3 S 7.1 8 S 19.0 13 S 30.9 18 S 42.8 23 S 54.7 28 S 66.8 33 S 78.5 34 S 90.4 43 S 114.2 53 S 126.1 53 S 126.1 53 S 149.6 64 S 169.8 73 S 173.7 78 S 169.8 43 S 190.5 43 S 202.2 100 S 223.2 100 S 223.2 100 S 225.1 108 S 258.9	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	37 50 85 83 108 143 184 232 259 292 343 381 388 374 357 309 247 71 109 59 59 25 7	22.1 22.1 22.1 22.1 22.1 22.1 22.1 23.1 35.7 44.2 55.7 57.8 65.5 65	7.1 19.0 30.9 42.8 54.7 88.8 78.5 45.2 57.1 83.1 89.0 75.0 80.9 88.9 92.8 98.8 104.7 110.0 110.0	6 17 28 39 50 61 41 47 52 57 63 68 74 79 95 100 100 100	15 17 28 39 50 61 141 47 52 57 63 74 79 84 90 95 100 100 100	26 26 26 33 42 52 52 34 43 48 59 65 71 77 92 100 100 100	22.1 22.1 28.1 35.7 44.2 52.9 33.2 36.6 40.9 45.9 55.3 85.0 85.0 85.0 85.0	15 500 685 83 106 143 184 232 259 234 1 388 1 374 357 171 109 59 25 7 2	332 1105 1437 2332 3784 6321 9967 6705 8599 10867 13972 1488 1478 2088 21583 20174 1748 13372 2265 5915 5915 5915 5916 1007 10	0.0 0.0 0.0 0.0 0.0 0.0 0.0 452 51.1 83.0 85.0 74.9 80.9 88.8 92.8 92.7 104.7 110.0 110.0	0 0 0 0 0 41 45 52 57 63 68 74 79 84 90 90 100 100 100	0 0 0 0 0 0 0 41 48 52 57 63 84 74 79 84 90 95 100 100 100	0 0 0 0 0 0 34 38 43 48 54 55 71 77 85 92 100 100 100	0.0 0.0 0.0 0.0 0.0 0.0 0.0 28.9 32.3 40.8 45.9 2 55.3 45.9 85.0 85.0 85.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0
DELIGING NOT DESIGN COMPRESSOR: COMP	<u> </u>		8602	<u> i</u>						4200	212778						3554	187537
DELIGING NOT DESIGN COMPRESSOR: COMP																		
DEMAND CONSUMPTION:	BUILDING NO: DESIGN LOAD: WINTER LOAD:	Ŀ	29005 836 0		COMPRI CONDE	ESSOR: NSER: ERANT:	H NO (LE	AO):		CENT WATER R-11		COMPRI CONDE REFRIG	ESSOR: SER: ERANT:	i no (cx	9 1).		CENT WATER R-11	
ENERGY COST: \$158,510	CONSUMPTION:		1522072	KWH/YR	CONFIG MAX LE	URATION AD SETP		RATE LO	AD:	SERIES/S	NGLE	CONFIG MIN LAG	URATION SETPON				SERIES/S	SINGLE
Name	ENERGY COST: TOTAL COST:	·	\$38,530 \$158,610	Λ/R Λ/R	RATED	CAPACIT POWER:				438.0 400.0	TONS KW	RATED	CAPACIT				400.0	TONS I
TONS TONS HRVR KW TONS % % KW HRVR KWHYR TONS % % KW HRVR TONS % KWHYR TONS % % KW HRVR TONS % KWHYR T	PLANT LOAD DSGN	LOAD	OCCUR			RAT	RAT	RAT	POWER	OCCUR	ENERGY		RAT CAP	RAT	RAT	POWER	OCCUR	ENERGY
0 W 0.0 0.0 4380 0.0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	İ	TONS	HR/YR	KW	TONS			%	ĸw	HRYR	кwнуя	TONS			%	ĸw	HR/YR	KWHYR
	3 S 25.1 8 S 88.9 13 S 109.7 18 S 180.5 23 S 192.3 128 S 224.1 23 S 227.9 24 S 317.7 43 S 399.5 44 S 3401.3 53 S 443.1 53 S 443.1 53 S 528.5 73 S 602.1 23 S 528.5 73 S 602.1 24 S 528.5 75 S 602.1 26 S 62.1 27 S 602.1 28 S 62.1 29 S 603.9 30 S 603.9 31 S 603.9	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	37 50 65 83 108 143 184 222 259 292 243 381 388 374 74 171 109 50 50 50 7	104.0 104.0 104.0 104.0 104.0 120.0 148.0 180.0 1216.0 256.0 256.0 320.0 355.0 355.0 356.0 520.0 568.0 1476.0 520.0 568.0 168.	25.1 88.9 108.7 150.5 192.3 234.1 275.9 317.7 196.5 238.3 280.1 321.9 210.1 251.9 292.7 335.5 285.5 307.3 349.1 309.9 432.7	6 15 25 25 35 44 54 54 55 55 55 56 64 77 77 51 61 61 90 90 90	15 15 25 35 44 54 63 73 35 64 74 48 58 67 77 77 70 80 90	26 26 30 37 45 54 64 30 38 48 89 55 65 40 58 89 42 52 81 72 83 83 84 84 85 85 85 85 85 85 86 86 86 86 86 86 86 86 86 86 86 86 86	104.0 104.0 104.0 120.0 148.0 218.0 228.0 120.0 184.0 220.0 184.0 220.0 184.0 232.0 248.0 249.0	15 50 65 83 106 143 144 222 259 202 343 381 388 374 357 308 247 171 109 50 50 50 7 7 7	1580 5200 6780 9980 15888 25740 30744 59392 31080 44384 63112 8322 100880 59840 69972 71458 84172 22872 22723 22723 22723 22732 2273	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0 0 0 0 0 0 0 0 0 0 0 40 40 40 40 70 70 70 70 70 100 100 100	0 0 0 0 0 0 0 0 40 40 40 40 70 70 70 70 100 100 100	0 0 0 0 0 0 0 0 0 0 0 34 34 34 34 36 100 100 100 100 100	0.0 0.0 0.0 0.0 0.0 0.0 138.0 138.0 138.0 244.0 244.0 400.0 400.0	0 0 0 0 0 0 0 0 0 0 0 259 292 343 381 388 374 357 308 247 171 109 50 50 57 7	0 0 0 0 0 0 0 0 0 0
	118 \$ 986.5	38.5		800.0	436.0	100	100	100	400.0	-		i	100	100	100	400,0		

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

		19		MASIE	CHILLER	NO (LE	W):		28	
BUILDING NO: DESIGN LOAD:		31008 458	TONS	COMPRI	ESSOR:				SCREW	
WINTER LOAD:		0	%DSGN	CONDE					WATER	
SIMULATION MODEL:		EQ-1	i	REFRIG					R-22	
DEAK DEMAND		201.0		STATUS	:				EXISTING)
PEAK DEMAND: CONSUMPTION:		301.0 654069	KWHYR I	CONFIG	URATION				SINGLE	
OCHIOCHE I IOIL		004000	Kinzin				RATELO	AD:	NA	%
DEMAND COST:		\$45,933	MR i	LOAD LI					100	%
ENERGY COST:		\$15,698	AND I							
TOTAL COST:		\$61,630	/YR	RATED	CAPACITY	r:			460.0 301.0	TONS KW
UNIT OUTPUT COST:		\$134	/TONTYR		EFFICIEN	CY:			0.854	KW/TON
% PLANT	PLANT	ANNUAL	PLANT	CHE.	%	%	%	POWER	ANNUAL	ANNUAL
PLANT LOAD DSGN	LOAD	OCCUR ACTUAL	DEMAND	LOAD	RAT	RAT ÇAP	RAT POW		OCCUR ADJUST	CONSUMP
LOAD	SHED	ACTUAL			ACT	ADJ	FOW		ALMUST	CONSUMP
		1104/0		70110						
% TONS	TONS	HR/YR	KW	TONS	*	<u>*</u>	_ *	ĸw	HRYR	KWHYR
0 W 0.0 3 S 13.7	0.0	4380 37	0.0 § 78.3	0.0 13.7	3	0 15	0 26	0.0 78.3	7	0 548
8 S 36.6	0.0	50	78.3	36.6		15	26	78.3	27	2114
13 S 59.5	0.0	65	78.3	59.5	13	15	26	78.3	58	4385
18 5 82.4	0.0	83	78.3	82.4	18	18	26	78.3	83	6499
23 S 105.3	0.0	108	78.3	105.3	23	23	26	78.3	106	8300
28 S 128.2 33 S 151.1	0.0 0.0	143 184	78.3 84.3	128.2 151.1	28 33	28 33	26 28	78.3 84.3	143 184	11197 15511
38 S 174.0	0.0	232	96.3	174.0	38	38	32	98.3	232	22342
43 5 196.9	0.0	259	108.4	196.9	43	43	36	108.4	259	28076
48 S 219.8	0.0	292	120.4	219.8	48	48	40	120.4	292	35157
53 S 242.7 58 S 265.6	0.0	343 381	132.4 147.5	242.7 265.6	53 58	53 58	44	132.4 147.5	343 381	45413 58198
83 S 288.5	0.0	388	162.5	288.5	58 6 3	63	54	162.5	381	63050
68 S 311,4	0.0	374	177.8	311.4	68	68	59	177.6	374	88422
73 5 334.3	0.0	357	192.8	334.3	73	73	64	192,6	357	68758
78 S 357.2 83 S 380.1	0.0 0.0	308 247	210.7 228.8	357.2 380.1	78 83	78 83	70 78	210.7	308 247	64896 56514
88 5 403.0	0.0	171	246.8	403.0	88	88	82	248.8	171	42203
93 S 425.9	0.0	109	287.9	425.9	93	93	89	267.9	109	29201
98 5 448.8	0.0	59	289.0	448.8	98	98	98	289.0	59	17051
103 S 471.7 109 S 494.6	11.7 34.6	25 7	301.0 j 301.0 j	460.0 460.0	100	100	100	301.0 301.0	25	7525 2107
113 S 517.5	57.5	2	301.0	460.0	100	100	100	301.0	7 2	602
118 S 540.4	80.4	ō	301.0	460.0	100	100	100	301.0	ō	0
		8602	1						4160	654069
		20	1	MASTER	CHILLER	NO (LE	AD):		29	
BUILDING NO:		34008	T0110			NO (LE	AD):	-		-
BUILDING NO: DESIGN LOAD:		34008 465	TONS	COMPRI	ESSOR:	NO (LE	AD):	-	SCREW	
BUILDING NO: DESIGN LOAD: WINTER LOAD:		34008 485 0	TONS %DSGN	COMPRI	ESSOR: ISER:	NO (LE	AD):	-		
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL:		34008 485 0 EQ-1	%DSGN	COMPRI	ESSOR: ISER: ERANT:	NO (LE	AD):	-	SCREW WATER	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND:		34008 485 0 EQ-1	%DSGN KW	COMPRI CONDEN REFRIGI STATUS	ESSOR: ISER: ERANT:		AD):		SCREW WATER R-22 EXISTING	1
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND:	÷	34008 485 0 EQ-1	%DSGN	COMPRISONDER REFRIGI STATUS CONFIG	ESSOR: ISER: ERANT: : URATION	:		A.D.	SCREW WATER R-22 EXISTING SINGLE	
BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION:		34008 485 0 EQ-1 301.0 695935	*LDSGN KW KWHYR	COMPRICONDEN REFRIGI STATUS CONFIG MAX LEA	ESSOR: ISER: ERANT: : URATION AD SETPT	:	AD):	AD:	SCREW WATER R-22 EXISTING SINGLE NA	%
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST:		34008 485 0 EQ-1	%DSGN KW	COMPRISONDER REFRIGI STATUS CONFIG	ESSOR: ISER: ERANT: : URATION AD SETPT	:		AD:	SCREW WATER R-22 EXISTING SINGLE	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: CONSUMPTION: DEMAND COST: ENERGY COST:		34008 485 0 EQ-1 301.0 695935 \$45,933	%DSGN KW KWHYR	COMPRISONDER REFRIGI STATUS CONFIG: MAX LE/ LOAD LI	ESSOR: ISER: ERANT: : URATION ND SETPT MIT:	: f or PRO-		AD:	SCREW WATER R-22 EXISTING SINGLE NA 100	% % TONS
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST:	<u></u>	34008 485 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,635	*LDSGN KW KWHYR YR YR YR	COMPRICONDER REFRIGI STATUS CONFIGMAX LEA LOAD LI RATED (RATED I	ESSOR: ISER: ERANT: : URATION AD SETPT MIT: CAPACITY POWER:	: f or PRO- f:		AD:	SCREW WATER R-22 EXISTING SINGLE NA 100 460.0 301.0	% % TONS KW
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST:	-	34008 485 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,835 \$138	*LDSGN KW KWHIYR IYR IYR IYR ITONIYR	COMPRI CONDEN REFRIG STATUS CONFIG MAX LEA LOAD LI RATED (RATED I	ESSOR: USER: URATION AD SETPT MIT: CAPACITY POWER: EFFICIEN	: f or PRO- f: CY:	RATE LO		SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854	% % TONS KW KW/TON
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAX DEBAIND: CONSUMPTION: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: WINT OUTPUT COST:	PLANT	34008 465 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,835 \$138	*LDSGN KW KWHYR /YR /YR /TONTYR	COMPRICONDER REFRIGI STATUS CONFIGMAX LEAL LOAD LI RATED I RATED I	ESSOR: ISER: ISER: ISERANT: IS	: f or PRO- f: CY:	RATE LO	AD: POWER	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.654	% tons kw kw/ton
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DBMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: VALUE TO THE COST: PLANT LOAD	PLANT LOAD SHED	34008 485 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,835 \$136 ANNUAL OCCUR	*LDSGN KW KWHIYR IYR IYR IYR ITONIYR	COMPRI CONDEN REFRIG STATUS CONFIG MAX LEA LOAD LI RATED (RATED I	ESSOR: ISER: ISER: URATION AD SETPT MIT: CAPACITO POWER: EFFICIEN RAT	t or PRO-	RATE LO		SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR	% % TONS KW KW/TON ANNUAL ENERGY
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: % PLANT PLANT LOAD DOSON	LOAD	34008 465 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,835 \$138	*LDSGN KW KWHYR /YR /YR /TONTYR	COMPRICONDER REFRIGI STATUS CONFIGMAX LEAL LOAD LI RATED I RATED I	ESSOR: ISER: ISER: ISERANT: IS	: f or PRO- f: CY:	RATE LO		SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.654	% tons kw kw/ton
BULDING NO: DESIGN LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD DESIGN LOAD DESIGN LOAD DESIGN LOAD	LOAD	34008 485 0 EQ-1 301.0 695935 \$45,933 \$18,702 \$62,835 \$136 ANNUAL OCCUR	*LDSGN KW KWHYR /YR /YR /TONTYR	COMPRICONDER REFRIGI STATUS CONFIGMAX LEAL LOAD LI RATED I RATED I	ESSOR: ISER: ISER: ISERANT: IS	CY:	RATE LO		SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR	% % TONS KW KW/TON ANNUAL ENERGY
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: ** PLANT LOAD DSSGN LOAD ** TONS 0 W 0.0	TONS	34008 485 0 EQ-1 301.0 605935 \$45,933 \$18,702 \$62,835 \$138 ANNUAL OCCUR ACTUAL HR/YR 4380	*LDSGN KW KWHYR YR YR YR /TON'YR PLANT DEMAND KW 0.0	COMPRISON CONDES REFRIGION STATUS CONFIGM MAX LEVEL OAD LITTLE CONFIGM	ESSOR: ISER: ISER: ISERANT: IURATION IN DISETPT MIT: CAPACITY POWER: EFFICIEN AT CAP ACT	CY: RAT CAP ADJ	RATE LO	POWER	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR ADJUST	% % TONS KW KW/TON ANNUAL ENERGY CONSUMP
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BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DBAND: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: UNIT OUTPUT COST: UNIT OUTPUT COST: V. TONS O W 0.0 3 S 14.8 8 S 38.8 13 S 63.1 14.3 23 S 100.1 24 S 63.3 25 S 63.3 26 S 63.3 26 S 63.3 27 S 63.3 28 S 63.4 28 S 63.3 28 S 64.8	TONS 1000 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	34008 445 46 0	*XDSGN KW KWHYR /YR /YR /YR /YR /YR /YR /TONTYR PLANT DEMAND KW 0.0 1 78.3 1 78.3 1 78.3 1 78.3 1 78.3 1 102.3 1 114.4 126.4 141.5 156.5 1 157.6 2 157.7 2 258.8 246.8 267.9 269.0	COMPRIGONDER CONDER GENERAL CONFIG MAX LE/ LOAD LI RATED 0 RATED 1 RA	ESSOR: ISSER: URATION IO SETP1	CCY:	% RATE LO % RAT POW % 28 29 26 28 30 34 38 42 47 75 25 77 83 69 75 82 89 96	POWER KW 0.0 0.0 78.3 78.3 78.3 78.3 78.3 102.3 114.4 126.4 141.5 171.6 189.8 207.7 225.8 267.9 289.0	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR ADJUST HR/YR 0 7 7 81 83 106 143 232 259 292 343 381 388 374 357 308 374 7171 100	% TONS KW KWITON ANNUAL ENERGY CONSUMP KWH/YR 0 548 2114 4776 6499 8300 11107 16815 22724 29830 29900 48535 59627 68581 70910 74149 69546 60960 45811 31501
PLANT LOAD DSGN LOAD DSGN LOAD SGN LOAD	TONS	34008 A85 A85 A85 A85 A85 A85 A85 A85 A85 A8	*XDSGN KW KWHAYR //R //R //R //R //R //R //R	COMPRIGON CONTROL CONT	ESSOR: SSER:	CCY:	% RATE LO % RATE POW % 0 28 28 28 830 344 247 52 527 53 89 96 8100	0.0 783 783 783 783 783 1023 1144 1264 1415 156.5 171.6 189.8 207.7 225.8 246.9 289.0 301.0	SCREW WATER R-22 EXISTING SINGLE NA 100 460.0 301.0 0.854 ANNUAL OCCUR ADJUST HRAYR 0 7 27 61 83 106 143 184 235 259 292 343 381 388 374 357 208 247 1100 59	% % % TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR 0 0 44778 6499 2300 36900 48535 59627 68561 68561 69561 6956 6950 45811 31501 17759
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEBAND: PEAK DEBAND: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: W. TONS: 0 W 0.0 3 S 14.8 8 S 38.8 13 S 63.1 13 S 63.	TONS	34008 445 46 0	*XDSGN KW KWHYR /YR /YR /YR /YR /YR /YR /TONTYR PLANT DEMAND KW 0.0 1 78.3 1 78.3 1 78.3 1 78.3 1 78.3 1 102.3 1 114.4 126.4 141.5 156.5 1 157.6 2 157.7 2 258.8 246.8 267.9 269.0	COMPRIGONDER CONDER CONDER GEFRING EFFRING MAX LE/ LOAD CHL LOAD TONS 0.0 14.6 38.8 63.1 181.3 208.6 232.8 257.1 281.3 305.6 322.8 354.1 378.2 402.6 426.8	ESSOR: ISSER: URATION (D SETPI) WIT: URATION	CCY: % RAT CAP ADJ 0 15 15 19 24 40 45 56 16 66 67 72 77 82 88 93 8100 100 100 100 100 100 100 100 100 10	% RATE LO % RAT POW % 0 28 28 26 26 26 30 34 38 42 47 75 25 77 83 89 75 6 82 89 96 100 100 100 100 100 100 100 100 100 10	0.0 78.3 78.3 78.3 78.3 78.3 102.3 114.4 126.4 1415.5 171.6 189.6 207.7 225.8 267.9 301.0	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 81 104 31 184 232 259 2343 381 388 374 357 308 247 171 100 59 25	% % TONS KW KWITON ANNUAL ENERGY CONSUMP KWH-VYR 0 544 4776 64999 8300 11107 16815 22724 29830 39900 48535 59627 59627 59627 68581 70910 74149 69546 60960 45811 31501 17759 7525
BULDING NO: DESIGN LOAD: WITER LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: WITER LOAD O W 0.0 3 S 14.8 S 39.8 13 S 63.1 18 S 87.3 23 S 111.8 8 S 39.8 13 S 63.1 18 S 39.8 13 S 10.1 15 S 10.1 16 S 10.8 17 S 10.8 18 S 30.8 19 S 10.1	TONS	34008 485 60 EQ-1 301.0 SEC. 1 100 *XDSGN KW KWHYR YR YR YR YR TONTYR PLANT DEMAND 0.0 78.3 78.3 78.3 78.3 78.3 102.3 114.4 126.4 141.5 156.5 171.6 189.6 207.7 225.8 248.8 267.9 248.8 267.9 269.0 301.0 301.0 301.0	COMPRIGON CONDENS CONDENS CONTROL CONT	ESSOR: ISER: SERIANT: URATION ID SETPIN IMIT: CAPACITI MIT: CCY: % RAT CCAP ADJ 15 15 15 19 24 40 45 56 86 87 77 82 88 93 100 100 100 100	% RATE LO % RAT POW % 0 26 26 26 26 30 34 38 42 47 75 25 73 89 975 58 20 89 98 100 100 100 100 100 100 100 100 100 10	0.0 78.3 78.3 78.3 78.3 78.3 78.3 102.3 114.4 126.4 141.5 171.6 189.6 207.7 225.8 246.8 267.9 289.0 301.0 301.0 301.0	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 811 83 108 143 184 232 259 2343 381 388 374 357 308 247 171 100 59 25 7 7 2	% % % TONS KW KW/YON ANNUAL ENERGY CONSUMP KWH/YR 0 0 548 2114 4778 6499 83000 11197 18815 23734 29830 38909 48535 59827 68581 70910 74149 69548 600900 458111 31501 17759 7525 2107 802		
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WINTOUTPUT COST: UNIT OUTPUT COST: VALUE COST: UNIT OUTPUT COST: VALUE COST: UNIT OUTPUT COST: VALUE COST:	TONS	34008 A85 A85 A85 A85 A85 A85 A85 A85 A85 A8	*XDSGN KW KWHYR //R //R //R //R //R //R //R	COMPRIGONDER CONDER CONDER CONDER CONFIGURA CO	ESSOR: ISER: URATION NO SETPI- URATION NO SETPI- CAPACITY OF THE CAPACITY OF T	" or PRO- " CCY: " A A D J " A A D J " S 15 15 15 15 15 15 15 16 20 30 35 40 40 45 51 58 81 88 89 98 99 98 90 100 100	% RATE LO % RAT POW % 0 26 26 26 28 28 30 34 42 47 52 26 30 95 5 82 99 98 100 100 100 100 100 100 100 100 100 10	0.0 783 783 783 783 783 1023 1024 1144 1264 1198 207.7 725.8 248.9 269.0 301.0 301.0	SCREW WATER R-22 EXISTING SINGLE NA 100 480.0 301.0 0.854 ANNUAL OCCUR ADJUST HRAYR 0 7 27 51 83 106 143 235 259 243 381 388 374 357 308 247 171 100 59 25 7	% % TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR 0 544 2114 4778 6499 8300 38900 48535 59027 86581 70910 71149 6155 66581 70910 71149 7152 7525 7525 7525 2107

APPENDIX I

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

			TONS KW KW/TON	ANNUAL ENERGY CONSUMP	KWHWR	00	-	0 0			-		•	61608	70034	74538	71795	61305	46290	31556	18414	2527	752	0	623689
35	CENT WATER R-11 EXISTING	PARALLEL 100 %	477.0 T 376.0 K 0.788 K	ANNUAL A OCCUR E ADJUST C	HRYR K	00	•	0 0	• •	•	•	• •	•	38.0	388	374	000	247	171	90	D 4	-	~	•	2428
	0,52.4			POWER	KW	0.0	0.0	0.0	9 0	0.0	0.0	0 0	0.0	1617	180.5	199.3	2 5	248.2	270.7	289.5	312.1	361.0	376.0	376.0	
				RAT Pow	*	00	• •	•	9 0	0	0	• •	0	٥ ٢	4	63	2	9 9	75	11	e e	9	100	100	
10 (LAG 2			ا	PAT AD	×	•	• •	0 (> 0	• •	0	00	•	0 0	67	62	4 6	75	90	4	O (9 0	00	90	
HLER	SOR: ANT:	LATION:	PACITY: WER: FICIENCY	* RAT CAP ACT	×	0 0	•	0	0 0	• •	0	• •	0	0 2	24	62	8 :	12	80	8	G (2 0	ŝ	100	
MASTER CHILLER NO (LAG 2):	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	CHIL LOAD	TONS	0.0	00	0.0	0 0	000	0.0	0 0	0.0	0.0	271.9	203.4	315.0	358.1	379.6	401.2	122.0	488.0	477.0	477.0	
		**	TONS KW KW/TON	ANNUAL ENERGY CONSUMP	KWHYR	0 4	•	0	0 0	12165	18400	34318	43800	40059	46560	49555	50873	40755	30780	20983	12243	200	009	0	642711
30	CENT WATER R-11 EXISTING	PARALLEL NA 100	400.0 250.0 0.625	ANNUAL OCCUR ADJUST	HRWR	0.0	•	0	•	¥3.	184	223	202	8	388	374	357	247	17	109	20	9 -	۰ ۵۰	•	3881
				POWER	×	0.0	9 0	0.0	0 0	85.0	100.0	115.0	150.0	172.5	120.0	132.5	142.5	165.0	180.0	192.5	207.6	277.0	260.0	250.0	
±				* RAT Pow	*	0	• •	•	0 0	8	ç	4 5	8 8	69	4 4	23	57	99	72	7.7	83	2 6	000	100	
10 (LAG 1			ÿ	*RAT AD O	*	0	• •	0	0 0	9	48	20 e	8	22	2 29	62	99	2 %	90	8	9	3	000	100	
HLLER	SOR: ER:	RATION: SETPOINT	PACITY: SWER: FICIENC	RAT CAP ACT	×	0	• •	0	•	9	48	50	9	22	26	62	9 1	2 %	9	4	8		90	100	
MASTER CHILLER NO (LAG 1):	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: MIN LAG SETPOINT LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	CHIL	TONS	0.0	0 0	0.0	0.0	161.7	190.8	219.5	277.2	306.1	227.0	246.0	264.1	3003	318.4	336.5	354.5	372.7	400.0	400.0	
			TONS KW KW/TON	ANNUAL ENERGY CONSUMP	KWHYR	523848	1395	1 2209	8707	11869	17958	26030	42749	67761	39987	48358	49659	46600	30045	20481	11948	6430	9634	0	1086615
31	CENT WATER R-11 EXISTING	PARALLEL 80 100	400.0 244.0 0.610	ANNUAL OCCUR ADJUST	HRYR	4380	25	99	83	143	184	332	292	343	381	374	357	308	12	100	69	55	- ~	0	8587
		2.5		POWER	ΚM	119.6	2 2	78.1	104.9	139.1	97.6	112.2	146.4	168.4	2 -	129.3	139.1	151.3	176.7	187.9	202.5	217.2	234.2	244.0	
*		-RATE LOAD		#AT Pow	*	\$	9 6	35	£3	24	\$ 9	4 (3 8	69	43	23	24	85	200	1.	83	3	8 9	200	
40 (LEAD):			تو	AP PA	×	89	5 5	38	25	9 9	4	92	7 O	11	2 2	6 6	99	7 1	0 0	4	8	69	œ ç	000	
HELER	SSOR:	RATION: SETPT (IT:	APACITY: DWER: FFICIENC	* F 4 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	×	89	ې د	8	25	9 9	4	20	9 0	11	25	62	99	7	0 0	9	8	8	9 5	9 6	
MASTER CHILLER NO (LI	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: MAX LEAD SETPT or PR LOAD LIMIT:	RATED CAPACITY: RATED POWER: RATED EFFICIENCY:	CHIL	TONS	0.162	34.7	160.2	207.9	265.7	100.6	219.5	248.4	306.1	209.8	246.0	264.1	282.2	300.3	336.5	354.6	372.7	390.7	400.0	
	TONS %DSGN	KW KWH/YR	A'R A'R TON'YR	PLANT DEMAND		119.6	7.0	78.1	104.9	139.1	107.6	227.2	261.8	340.0	374.1	461.1	495.9	539.4	5/4.2	0.000	722.1	774.3	835.2	870.0	
21	36000 1155 20 EQ-3	870.0 2153015 \$132,762	\$51,672 \$184,434 \$144	ANNUAL OCCUR ACTUAL	HRYR	4380	37	9 60	83	106	184	232	250	343	381	374	357	308	247	001	9	26	~ (N 0	8602
				PLANT LOAD SHED	TONS	0.0	0.0	0.0	0.0	0.0	9 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9 6	0.0	0.0	0.0	85.9	
	BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE.:	NOT:	ENERGY COST: TOTAL COST: UNIT OUTPUT COST:	PLANT	TONS	231.0	24.7	150.2	207.9	265.7	323.4	438.9	496.7	612.2	6.699	727.7	943.2	6.000	958.7	1016.4	1131.0	1189.7	1247.4	1305.2	
PLANT NO:	BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION M	PEAK DEMAND: CONSUMPTION DEMAND COST	ENERGY COST: TOTAL COST: UNIT OUTPUT C	PLANT L	-	20 W	9	n v.	2 2	23 S	28 50	38.5	\$ 5	53 S		63				200	2 0	103 S	106 S	113 5	

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT				22		MASTER	CHILLE	R NO (LE	AD):		33	
BULLD				36006								
DESIG				259	TONS	COMPR					CENT	
		OAD:		0	%DSGN	CONDE					WATER	
JUMIE	ATH	ON MODEL:		EQ-1		REFRIG					R-11	
XAY.	DEL	AAND:		185.0	KW	STATUS	:				EXISTING	3
		TION:		376362	KWH/YR	CONEG	URATION	ŀ			SINGLE	
				3/0302	New All		AD SETP		DATELO	A Dr	NA NA	*
YEALA	ND	COST:		\$28,231	A/B	LOADLI		i di Filo-	DATELO	AD.	100	%
		COST:		\$9,033	A/B	LUNDE					100	~
TOTAL				\$37,264	A/B	RATED	CAPACIT	٧٠			275.0	TONS
				407,204		RATED		••			185.0	KW
JNIT (TUC	PUT ∞ST:		\$136	/TON°YR		EFFICIEN	CY:			0.673	KW/TON
6		PLANT	PLANT	ANNUAL	PLANT I	CHIL		~ ·	%	POWER	ANNUAL	ANNUAL
TAN	r	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	BAT	RAT		OCCUR	ENERGY
DSGN			SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUM
OAD					į		ACT	ADJ				
×.		TONS	TONS	HR/YR	ĸw	TONS	%	*	%	ĸw	HRYR	KWHYR
	w	0.0	0.0	4380	0.0	0.0	0			0.0		
3		7.8	0.0	37	48.1	7.8	3	15	26	48.1	7	33
8		20.7	0.0	50	48.1	20.7	8	15	25	48.1	27	129
13		33.7	0.0	65	48.1	33.7	12	15	26	48.1	52	250
18		46.6	0.0	83	48.1	46.8	17	17	26	48.1	83	399
23		59.6	0.0	106	48.1	59.8	22	22	26	48.1	106	509
28		72.5	0.0	143	48.1	72.5	26	26	26	48.1	143	687
33		85.5	0.0	184	50.0	85.5	31	31	27	60.0	184	920
38		98.4	0.0	232	55.5	98.4	36	38	30	55.5	232	1287
43 48	S	111.4 124.3	0.0	259	62.9	111.4	41	41	34	62.9	259	1629
53		137.3	0.0	292 343	70.3 77.7	124.3	45 50	45 50	38	70.3	292	2052
58		150.2	0.0	343	85.1	137.3 150.2	50 55	50 55	42	77.7	343	2665
63		163.2	0.0	381	92.5	163.2	56 59	55 59	46 50	85.1	381	3242
68	s	178.1	0.0	374	101.8	178.1	54	84	50 55	92.5 101.8	388 374	3589
73	s	189.1	0.0	357	111.0	189.1	69	69	50	111.0	357	3807
78		202.0	0.0	308	118.4	202.0	73	73	64	111.0	357	3962° 3646°
83	s	215.0	0.0	247	129.5	215.0	78	78	70	129.5	247	3198
88	Š	227.9	0.0	171	140.6	227.9	83	83	76	140.6	171	2404
93	s	240.9	0.0	109	161.7	240.9	88	83 88	82	151.7	109	1653
98	Š	253.8	0.0	59	162.8	253.8	92	92	88	162.8	59	960
103		266.8	0.0	25	175.8	268.8	97	97	95	175.8	25	439
108		279.7	4.7	25 7	185.0	275.0	100	100	100	185.0	25 7	
113		292.7	17.7	2	185.0	275.0	100	100			2	129
118		305.6	30.6	0	185.0 185.0	275.0	100	100	100	185.0 185.0	0	37
	-						,,,,			100.0		
				8602							4158	376382

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT NO:			23	T	MASTER	CHILLER	NO (LEA	D):		34	!	•						
BUILDING P DESIGN LO WINTER LO	NO: OAD:		36009 110 0 EQ-1	TONS	COMPRE CONDEN REFRIGE STATUS:	SER: RANT:				RECIP AIR R-22 EXISTING								
PEAK DEM CONSUMP			95.5 245490	KWHYR I	CONFIGU MAX LEA	RATION:		ATE LO	ND:	SINGLE NA 100	%							
DEMAND C ENERGY C TOTAL CO	OST:		\$14,573 \$5,892 \$20,465	AR I	RATED C	APACITY	:			95.5 95.5 E	TONS I							
NIT OUTP	UT COST:		\$214	/TONTYR	RATED E					1.000	KW/TON	•						
	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	% RAT CAP ACT	RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ENERGY CONSUMP							
	TONS	TONS	HR/YR	kw i	TONS	*	*	*	ĸw	HR/YR	KWH/YR							
0 W 3 S S S S S S S S S S S S S S S S S S	0.0 3.8 8.8 149.8 25.3 363.3 41.8 52.8 53.8 63.8 63.8 63.8 102.8 113.3 113.3 114.3 124.3	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 37 50 83 108 143 184 232 259 202 343 381 388 387 37 100 59 27 27 27 27 27 27 27 27 27 27	0.0 220 220 220 220 220 220 220 220 220 220 23.9 28.7 35.3 42.0 45.8 56.3 56.5 65.5 65.5 95.5	0.0 33 8.8 14.3 19.8 25.3 30.8 41.3 58.3 63.8 69.3 74.8 80.3 85.8 91.3 95.5 95.5 95.5 95.5	0 3 9 15 26 32 38 44 55 81 67 73 78 4 90 100 100 100 100 100	0 15 15 15 28 32 38 44 50 55 61 87 73 78 84 98 100 100 100 100	0 23 23 23 23 23 25 30 37 44 48 53 96 71 100 100 100 100	0.0 22.0 22.0 22.0 22.0 23.9 28.7 35.8 56.3 67.8 74.5 89.8 95.5 95.5 95.5 95.5 95.5	0 7 30 55 83 104 143 184 232 259 243 381 381 387 387 170 100 55 7	0 154 660 1430 1430 1828 2332 2418 8190 10878 13374 17356 24095 25357 22181 18331 10410 5635 2388 669 691 10 10 10 10 10 10 10							
			8602	i						4172	245490	_						
				<u>.</u> :							245490	- MASTER	CHILLER	NO (LA			35	
UILDING JESIGN L VINTER L	NO: OAD:	:	24 38014 98 1 10 EQ-1	TONS Subsequent	COMPRI CONDEI REFRIG	KSER: ERANT:		AD):		36 RECIP W WATER R-22	// HT REC	MASTER COMPRE CONDENS REFRIGE STATUS:	SSOR: SER:	NO (LA	G 1):	a.	35 ABSORP WATER LB-1 ABANDO	
UILDING ESIGN L INTER L IMULATI EAK DEA	NO: OAD: OAD: ON MODEL		24 38014 98 1		COMPRI CONDE REFRIG STATUS	ESSOR: NSER: ERANT:	ı:	AD):		36 RECIP W	// HT REC	COMPRE CONDENS REFRIGE STATUS: CONFIGU MIN LAG	SSOR: SER: RANT: PRATION SETPOR		G 1):		ABSORP WATER LB-1 ABANDO SERIES/ NA	NED SINGLE
UILDING DESIGN L VINTER L SIMULATI PEAK DEA CONSUMI DEWAND DEWAND	NO: OAD: OAD: ON MODEL MAND: PTION: COST: COST:	:	24 38014 98 1 10 EQ-1	*LDSGN	COMPRI CONDE REFRIG STATUS CONFIG MAX LE LOAD LI	ESSOR: USER: ERANT: URATION AD SETP' MIT: CAPACIT	i: T or PRO			38 RECIP WATER R-22 EXISTING SERIES/S NA 100 98.2	// HT REC	COMPRE CONDENS REFRIGE STATUS: CONFIGU MIN LAG LOAD LIN RATED C RATED P	SSOR: SER; RANT: IRATION SETPORAIT: APACITY OWER:	iT:	G 1):		ABSORP WATER LB-1 ABANDO SERIES/	NED SINGLE
UILDING ESIGN L INTER L IMULATI EAK DEA ONSUMI EMAND NERGY OTAL CO	NO: OAD: OAD: ON MODEL AAND: PTION: COST: COST: DST:	:	24 38014 98 10 10 EQ-1 87.8 250420 \$13,368 \$6,010 \$19,378 \$201	KW KWHYR KWHYR YR YR YR YR	COMPRI CONDEI REFRIG STATUS CONFIG MAX LE LOAD LI RATED RATED RATED	ESSOR: USER: ERANT: URATION AD SETP MIT: CAPACIT POWER: EFFICIEN	l: T or PRO- Y: ICY:	RATELO		SERIES/S NA 100 98.2 87.6 0.911	// HT REC	COMPRE CONDEN REFRIGE STATUS: CONFIGU MIN LAG LOAD LIN RATED C RATED P RATED E	SSOR: SER; RANT: IRATION SETPORAIT: APACITY OWER:	iT:		POWER	ABSORP WATER LB-1 ABANDO SERIES/ NA 100 48.0 NA \$25555	NED SINGLE TONS KW KW/TON
UILDING ESIGN L ENTER L IMULATI EAK DEA ONSUMI ENAND NERGY OTAL CO NIT OUT	NO: OAD: OAD: ON MODEL MAND: PTION: COST: COST: COST:		24 38014 96 7 10 EQ-1 87.8 250420 \$13,368 \$6,010 \$19,378	KW KWHYR MR AYR AYR	COMPRICONDES REFRIG STATUS CONFIG MAX LE LOAD LI RATED RATED	ESSOR: USER: ERANT: URATION AD SETP MIT: CAPACIT POWER:	l: T or PRO Y:	RATE LO	POWER	36 RECIP WATER R-22 EXISTING SERIES/S NA 100 98.2 87.8 0.911 ANNUAL OCCUR ADJUST	// HT REC SINGLE % TONS KW KW/TON ANNUAL BNERGY CONSUMP	COMPRE CONDENS REFRIGE STATUS: CONFIGUI MIN LAG LOAD LIN RATED C RATED P RATED E LOAD	SSOR: SER: RANT: SETPORALT: APACITO OWER: FFICIEN RAT CAP ACT	CY:	% RAT POW		ABSORP WATER LB-1 ABANDO SERIES/NA 100 48.0 NA \$333338 ANNUAL OCCUR ADJUST	NED SINGLE % TONS KW KW/TON ANNUAL BNERGY CONSUM
ULDING USIGN L VINTER	NO: OAD: OAD: OAD: ON MODEL MAND: PTION: COST: COST: PST: PUT COST LOAD TONS	PLANT LOAD SHED TONS	24 38014 98' 100 EQ-1 87.8 250420 \$13,368 \$9,010 \$19,278 \$201 ANNUAL OCCUR ACTUAL	KW KWHYR //R //R //R //R //ON'YR PLANT DEMAND	COMPRI CONDEI REFRIG STATUS CONFIG MAX LE LOAD LI RATED RATED CHL LOAD I TONS	ESSOR: ISER: ERANT: URATION AD SETP' MIT: CAPACIT POWER: EFFICIEN ACT ACT	I: T or PRO- Y: ICY: % RAT CAP ADJ	**************************************	POWER	38 RECIP WATER R-22 EXISTING SERIES/S NA 100 98.2 87.6 0.911 ANNUAL OCCUR ADJUST	// HT REC SINGLE % % TONS KW KW/TON ANNUAL ENERGY CONSUMP	COMPRE CONDENS REFRIGE STATUS: CONFIGU MIN LAG LOAD LIM RATED C RATED P RATED E CHIL	SSOR: SER: RANT: PRATION SETPOPAIT: APACITO OWER: FFICIEN KAT CAP ACT	CY:	% RAT	POWER	ABSORP WATER LB-1 ABANDO SERIES/ NA 100 48.0 NA \$23339 ANNUAL OCCUR	NED SINGLE % TONS KW KW/TON ANNUAL ENERGY
PEAK DEPAK D	OCO OCO	PLANT LOAD SHED TONS	24 38014 98 '8 '10 E0-1 87.8 250420 \$13,368 \$8,010 \$19,378 \$2011 ANNUAL CCUR ACTUAL HR/YR 4380 37 50 65 83 106 143,184 232 259 202 343,33 381 388	***COSGN KW KWHYR YR COMPRI CONDED CO	ESSOR: ISSER: SERIOR SE	: T or PRO- Y: ICY: % RAT CAP ADJ 15 15 15 15 15 15 15 15 15 15 15 15 15	**************************************	POWER 20.1 20.1 20.1 20.1 20.1 20.1 20.1 20.	36 RECIP W WATER R:22 EXISTING SERIES/S NA 100 96.2 87.6 0.911 ANNUAL OCCUR ADJUST HR/YR 2920 7 27 26 83 108 143 184 232 256 292 243 381 388	## HT REC ## TONS ## KW/TON ANNUAL BNERGY CONSUMP KWHYR 58892 141 1128	COMPRE CONDEN REFRIGE STATUS: CONFIGU MN LAG LOAD LIN RATED C RATED P RATED E LOAD TONS	SSOR: SER: RANT: IRATION SETPON SETPON MIT: APACITY APACITY CAP ACT 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	**CY: *** **ADJ ** ** ** ** ** ** ** ** **	% RAT POW % 0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	ABSORP WATER LB-1 ABANDO SERIES/NA 100 48.0 NA \$333333 ANNUAL OCCUR ADJUST HR/YR 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	NED SINGLE % TONS KW KWITON ANNUAL BNERGY CONSUM	
BULDING ESIGN LA WINTER IN	NO: OAD: OAD: OAD: OAD: OAD: OAD: OAD: OA	PLANT LOAD SHED 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	24 36014 36014 9 95 95 95 95 95 95 95 95 95 95 95 95 95 9	**LOSGN KW KWH/YR /YR /YR /YR /YR /TON'YR PLANT DEMAND KW 20.1	COMPRI CONDED CO	ESSOR: dSER: URATION AD SETP! WITH ADDRESS ADD	I: T or PRO- Y: "% RAT CAP ADJ "\$ 15 15 15 15 15 15 15 15 15 15 15 15 15 1	% RATE LC % RAT POW % 23 23 23 23 23 24 86 50 55 56 60 57 77 77 83 90 97 7100 100 100 100 100 100 100 100 100 1	POWER 20.1 20.1 20.1 20.1 20.1 20.1 20.1 20.	38 RECIP W WATER R-22 EXISTING SERIES/S NA 100 98.2 87.8 0.911 ANNUAL OCCUR ADJUST HR/YR 2920 7 7 27 66 83 108 143 134 232 256 292 343 381	## HT REC ## TONS ## KWTON ANNUAL BNERGY CONSUMP KWHYR 58892 1128 1128 1688 2131 2874 4195 6102 8159 10746 13823 16833	COMPRE CONDENS REFRIGE STATUS: CONFIGU MN LAG LOAD LIA RATED P RATED E CHE LOAD TONS 0.0	SSOR: SER: RANT: IRATION SETPON METALOR APACITI CAP ACT 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	**CY: *** **RATI CAP ADJ ** 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	% RAT POW	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	ABSORP WATER LB-1 ABANDO SERIES/NA 100 48.0 NA 255555 ANNUAL OCCUR ADJUST HR/YR	NED SINGLE % TONS KW TONS KWITON ANNUAL BNERGY CONSUM

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

BALCHOOL	PLANT NO:		25		MASTER	CHITTE	R NO (LE	AD):		38		MASTER	CHILLE	R NO (LA	G 1):		37	
Company	DESIGN LOAD: WINTER LOAD: SIMULATION MODEL:		980 0 EQ-2S	*Josqn	CONDE	ISER: ERANT:				WATER R-11	3	CONDE! REFRIG	VSER: ERANT;				WATER R-11	g
BAMAND COST \$193-98								DATELO									SERIES/	SINGLE
NATIONAL PLANT P	ENERGY COST:		\$37,980	MR	LOAD LI RATED	MIT: CAPACIT		-nate co	AU.	100 584.0	% TONS	LOAD LI	MIT: CAPACIT				100 631.0	% TONS
PAME CAMP	UNIT OUTPUT COST:		\$151	/TONTYR			CY:							ICY:				
S	PLANT LOAD DSGN	LOAD	OCCUR			RAT	RAT	RAT	POWER	OCCUR	ENERGY		RAT	RAT	RAT	POWER	OCCUR	ENERGY
3	% TONS	TONS	HRYR	KW	TONS	*	*	*	KW	HR/YR	KWH/YR	TONS	%	%	%	ĸw	HR/YR	KWHYR
BULDNO NO. DESIGN LOAD: 1034 TONS COMPRESSOR: CENT WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: WAT	3 S 29/4 8 S 78/4 13 S 178/4 13 S 178/4 23 S 225/4 23 S 225/4 23 S 322/4 23 S 322/4 34 S 372/4 43 S 470/4 43 S 470/4 53 S 519/4 53 S 519/4 53 S 519/4 53 S 617/4 68 S 568/4 73 S 715/4 83 S 813/4 178 S 764/4 178 S 765/4	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	37 50 85 83 106 143 184 232 259 292 343 381 388 374 357 308 247 1109 59 25 7 7	119.1 119.1 119.1 119.1 151.1 178.8 210.7 251.9 288.5 297.7 320.7 361.8 403.0 403.0 403.0 541.2 673.3 744.2 673.3 745.1 801.5 801.5	29.4 78.4 127.4 178.4 225.4 225.4 221.4 221.0 267.0 316.0 365.0 414.0 483.0 322.7 371.7 420.7 290.4 323.4 478.4 478.4	5 13 22 30 39 47 55 64 72 37 46 54 63 71 79 55 64 72 48 85 85 85 85 85 84 72 85 84 85 85 86 86 86 86 86 86 86 86 86 86 86 86 86	15 15 22 30 39 47 55 64 72 37 48 54 63 71 79 56 48 85 72 48 85 72 48 85 72 48 85 72 48 87 72 88 88 88 88 88 88 88 88 88 88 88 88 88	26 28 28 33 39 46 55 31 38 55 45 54 67 48 55 63 40 47 58 63 47 58	119.1 119.1 119.1 151.1 151.1 158.6 210.7 251.9 288.5 142.0 174.0 247.3 284.0 325.2 210.7 251.9 288.5 183.2 210.7 251.9 258.5 183.2 258.5	12 43 43 43 43 43 43 43 43 43 43 43 43 43	1429 5121 7742 9885 16017 25540 38769 58441 74722 41464 59682 106218 116098 64398 62219 19969 12703 6413 2052 687 60	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 252.4 252.4 252.4 252.4 252.4 252.4 352.4 352.4 351.0 831.0 831.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 34 34 34 34 34 31 81 100 100 100	0.0 0.0 0.0 0.0 0.0 0.0 0.0 155.7 155.7 155.7 155.7 155.7 458.0 458.0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 45464 53405 59322 60412 58232 58232 58232 58232 18055 80012 47777 49922 27022 211450 3208 918
BULDNO NO. DESIGN LOAD: 1034 TONS COMPRESSOR: CENT WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: COMPRESSOR: WATER COMPRESSOR: WAT																		
PEAK DEMAND: 905.0 KW 1908.00 KW 1908.0	DI ANTI NO.				- MACTED	~												
ENERGY COST: \$445,794 ATR	BUILDING NO: DESIGN LOAD: WINTER LOAD:		39043 1084 0		COMPRE CONDEN REFRIGE	SSOR: SER: RANT:	NO (LE	AD):		CENT WATER R-11		COMPRE CONDEN REFRIGE	SSOR: ISER: ERANT:	NO (LAC	3 1):		CENT WATER R-11	1
Y	BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION:	***************************************	39043 1084 0 EQ-2S 905.0 1908094	KW KWHYR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA	SSOR: SER: FRANT: URATION: D SETPT	:		AD:	CENT WATER R-11 EXISTING SERIES/S	NGLE %	COMPRE CONDEN REFRIGE STATUS: CONFIGU MIN LAG	SSOR: ISER: ERANT: JRATION SETPOIN	:	3 1):		CENT WATER R-11 EXISTING SERIES/S	SINGLE
TONS	BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: BNERGY COST: TOTAL COST:	-	39043 1084 0 0 EQ-25 905.0 1908094 \$138,103 \$45,794 \$183,897	KW KWHYR KWAN KWAN KWAN KWAN KWAN KWAN KWAN KWAN	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIA RATED C RATED P	SSOR: SER: RANT: DRATION: D SETPT AIT: APACITY OWER:	: or PRO-		AD:	CENT WATER R-11 EXISTING SERIES/S 80 100 560.0 452.0	NGLE % % TONS	COMPRE CONDEN REFRIGE STATUS: CONFIGE MIN LAG LOAD LIN RATED C RATED C	SSOR: ISER: IRANT: IRATION SETPOM MIT: CAPACITY OWER:	: NT: C:	3 1):		CENT WATER R-11 EXISTING SERIES/S 40 100 580.0 453.0	SINGLE
3 S 32.5 0.0 37 117.5 32.5 6 18 28 117.5 15 178.3 0.0 0 0 0 0 0.0 0 0 0 0 0 0 0 0 0 0 0	BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: BHERGY COST: TOTAL COST: UNIT OUTPUT COST: PLANT PLANT LOAD DSON	LOAD	39043 1084 0 EQ-2S 905.0 1908094 \$138,103 \$45,794 \$183,897 \$184 ANNUAL OCCUR	%DSGN KW KWHYR //R //R //TON'YR	COMPRE CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIM RATED C RATED P RATED E	SSOR: SER: SER: SERANT; JRATION: D SETPT MIT: SAPACITY OWER: FFICIENC RAT CAP	or PRO-	RATELO.		CENT WATER R-11 EXISTING SERIES/S 80 100 560.0 452.0 0.807 ANNUAL OCCUR	MGLE % TONS KW KW/TON ANNUAL ENERGY	COMPRE CONDEN REFRIGE STATUS: CONFIGU MIN LAG LOAD LIN RATED C RATED P RATED E CHIL	SSOR: SER: SERANT: JRATION SETPOIN AIT: CAPACITY OWER: FFICIENC RAT CAP	: NT: CY:	% RAT	POWER	CENT WATER R-11 EXISTING SERIES/S 40 100 560.0 453.0 0.809 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY
8602 4200 982181 3322 925913	BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: BHERGY COST: TOTAL COST: UNIT OUTPUT COST: WHENT LOAD DSON LOAD	SHED	39043 1084 0 0 EQ-2S 905.0 1908094 \$138.103 \$45.794 \$183.897 \$184 ANNUAL OCCUR ACTUAL	%DSGN KW KWHYR //R //R //R /TONTYR PLANT DBAAND	COMPRECONDEN REFRIGE STATUS: CONFIGUE MAX LEA LOAD LIA RATED C RATED C RATED C CHL LOAD	SSOR: SER: SER: SERANT: DRATION: D SETPT MIT: MAPACITY OWER: FFICIENC RAT CAP ACT	or PRO-	RATE LO. % RAT	POWER	CENT WATER R-11 EXISTING SERIES/S 80 100 580.0 452.0 0.807 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP	COMPRE CONDEN REFRIGE STATUS: CONFIGURE MIN LAG LOAD LIA RATED C RATED P RATED C RATED C RATED C	SSOR: ISER: IRANT: JRATION SETPON JIT: CAPACITY OWER: FFICIEN RAT CAP ACT	CY: % RAT CAP ADJ	% RAT POW		CENT WATER R-11 EXISTING SERIES/S 40 100 580.0 453.0 0.809 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP
	BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: BHERGY COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: TOTAL COAD S 3 2.5 S 8 8.7 TONS TONS S 90.0 S 32.5 S 8 86.7 TONS S 90.0 S 30.5 S 90.7 S 90.9 S 1008.1 S 1008.2 S 1008.1 S 1008.2 S 1008.1 S 1008.3 S 1008.1 S 1008.3 S 1008.1 S 1008.3 S 1008.1 S 1008.3 S 1008.1 S 108.1 S 108.2 S 108.2 S 108.3 S 108.3	TONS	39043 1094 0 0 EO-2S 9950 9 \$138,103 \$45,794 \$183,897 \$184 ANNUAL OCCUR ACTUAL HRV/R 4380 377 50 85 83 108 143 222 259 259 259 259 27 388 374 375 388 377 388 377 388 377 388 377 388 377 388 377 377	*LDSGN KW KWHUYR /YR /YR /YR /TON'YR FLANT DBAAND 117.5 117.5 117.5 117.5 117.5 1248.6 203.4 248.6 293.8 316.7 352.9 398.1 438.8 470.7 515.9 556.5 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 428.8 438.7 728.7 778.7 778.7 778.7 778.7 778.7 778.7 778.7 778.7 778.7 778.7 778.7 905.0 905.0	COMPRECONDENS CONTROL REFIRIGE CONFIGURA RATED C RATED P RATED E CHL LOAD TONS 00 32.5 86.7 140.9 195.1 249.3 303.5 357.7 411.9 242.1 296.3 350.5 404.7 200.9 345.1 399.3 285.5 399.7 399.3 285.5 580.0	SSOR: SER: RANT: SER: RANT: SER: RANT: DISTIPLE CONTROL OF SERIES	"CCY: "%" RATI CAP ADJ "%" 0 16 15 25 35 45 44 43 63 77 22 62 62 71 61 70 80 90 100	% RATE LO. % RAT POW % 0 28 28 29 39 39 45 55 55 56 54 42 42 42 42 42 42 42 42 42 42 42 42 42	0.0 117.5 117.5 117.5 135.6 171.3 203.4 243.8 162.7 198.9 244.1 284.8 293.8 162.7 198.9 244.1 284.8 293.8 293.8 194.4 239.8 24	CENT WATER R-11 EXISTING SERIES/S 80 100 560.0 452.0 0.807 ANNUAL OCCUR ADJUST HRAYR 0 15 50 65 83 106 83 106 83 107 308 37 308 247 171 100 59 7 7 2	** ** ** ** ** ** ** ** ** **	COMPRECONDEN REFRIGE CONDEN REFRIGE REFRIGE CONFIGE MIN LAG LOAD LE RATED P RATED E CHL LOAD TONS O.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	SSOR: SSER:	% ALJ % ALJ	% PAT POW % 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 154.0 154.0 154.0 278.3 278.3 453.0 453.0 453.0 453.0 453.0 453.0	CENT WATER R-11 EXISTINC SERIES/S 40 100 580.0 453.0 0.809 ANNUAL OCCUR ADJUST HR/YR 0 0 0 0 0 0 0 0 0 0 0 0 259 292 349 381 388 374 357 308 247 171 100 557 7 2	SRIGLE % % % TONS KW TONS KW KW/TON i ANNUAL ENERGY CONSUMP 0 1 39886 44988 44988 44988 44988 44988 45222 58674 107204 103336 108339 131891 77463 11891 77463 49377 26727 11325 3171 906

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PEAK DE CONSUM DEMAND ENERGY TOTAL CO	MAND: COST: COST: COST: COST: COST: COST: COST: COST: COST:	PLANT LOAD SHED	27 41003 232 0 EQ-1 199.0 442414 \$30,387 \$10,618 \$40,985 \$180 ANNUAL OCCUR ACTUAL	TONS %DSGN KW KWHYYR //R //R //R //TON'YR PLANT DEMAND	COMPRE CONDED REFRIGI STATUS: CONFIG MAX LEA LOAD LII RATED C RATED F	ISER: ERANT: E URATION D SETPT WIT: CAPACITY	: or PRO- /:	RATE LO	AD: POWER	CENT WATER R-12 EXISTING SINGLE NA 100 227.5 199.0 0.875 ANNUAL OCCUR ADJUST	% TONS KW KW/TON ANNUAL BNERGY CONSUMP
*	TONS	TONS	HRYR	KW 1	TONS	%	*	%	ĸw	HRYR	KWH/YR
0 WS 8 S 18	7.0 18.6 30.2 41.8 53.4 65.0 76.6 88.2 99.8 111.4 123.0 134.6 148.2 157.8 169.4 181.0 192.6 204.2 215.8 227.4 239.0 250.2	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 370 65 83 108 1434 232 259 202 343 381 388 374 357 7 101 101 59 25 50 7 20 20 20 20 20 20 20 20 20 20 20 20 20	0.0 51.7 51.7 51.7 51.7 61.7 51.7 51.7 57.7 81.8 81.8 90.5 109.5 119.4 129.4 143.3 129.2 189.2 189.0 199.0 199.0	0.0 7.0 18.8 30.2 41.8 65.0 76.8 88.2 90.8 111.4 123.0 134.8 146.2 157.8 169.4 181.0 204.2 215.8 227.4 227.5 227.5 227.5	0 3 8 13 18 23 29 34 39 44 49 54 89 54 80 85 90 91 100 100 100	0 15 15 15 18 23 29 34 39 44 49 54 80 85 90 95 100 100 100	0 26 26 26 26 26 26 26 29 33 37 41 45 50 65 72 78 85 92 100 100 100	0.0 51.7 51.7 51.7 51.7 51.7 51.7 65.7 73.8 89.5 109.5 119.4 143.3 155.2 189.1 199.0 199.0 199.0	0 7 7 27 56 83 108 144 212 259 292 343 381 388 374 357 308 247 171 109 59 57 7 2 2 0	90 362 1396 2895 4291 5480 7393 10617 15242 19062 23827 30733 37910 42488 44196 44136 3833 19058 11741 4975 1393 398
PLANT NO BUILDING DESIGN I WINTER I SIMULATI PEAK DE CONSUM DEMAND ENERGY TOTAL CO	MAND: COST: COST:		28 42000 189 0 EQ-1 190.0 368517 \$28,994 \$8,844 \$37,838	TONS %DSGN KW KWHYR //R //R	COMPRECONDER REFRIGI STATUS: CONFIGI MAX LEA LOAD LI	ERANT: URATION D SETPT	: or PRO-	AD):	AD:	CENT WATER R-11 EXISTING SINGLE NA 100 209.0 190.0	% % TONS
UNIT OUT	PUT COST:		\$181	/TON'YR		FFICIEN	CY:			0.909	KW/TON
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
%	TONS	TONS	HRYR	kw i	TONS	%	%	*	ĸw	HRYR	KWHYR
0 W 3 S S 13 S S 23 S S 23 S S 38 S S 43 S S 58 S S 58 S S 58 S S	5.7 15.1 24.6 34.0 43.5 52.9 62.4 71.8 81.3 90.7 100.2 109.6 119.1	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 37 50 65 83 108 143 232 259 292 343 381 388 374 357 308	0.0 49.4 49.4 49.4 49.4 49.4 49.4 49.4 55.1 62.7 68.4 78.0 61.7 91.2 198.8 108.3 117.8 125.4	0.0 5.7 15.1 24.8 34.0 43.5 52.9 82.4 71.8 81.3 90.7 100.2 109.8 119.1 128.5 138.0 147.4 156.9	0 3 7 12 16 21 25 30 34 39 43 48 57 61 66 71	0 15 15 16 21 25 30 34 39 43 48 52 57 61 86 71	0 26 26 26 26 26 26 27 33 36 40 48 52 57 68	0.0 49.4 49.4 49.4 49.4 49.4 49.4 55.1 62.7 68.4 76.0 81.7 91.2 98.8 108.3 117.8	0 7 7 23 52 83 106 143 184 232 259 292 343 381 388 374 357 308 247	0 348 1136 2569 4100 5238 7064 9090 12783 16239 19973 26068 31128 35386 36951 38663 36282 36282

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT P		10-		29 50001	!	MASTER	CHILLER	NO (LE	ND):		43		
					TONS	COMPRE	SSOR.				RECIP		
WINTER				20	*DSGN	CONDEN					AIR		
		N MODEL:		EQ-1		REFRIGI					R-22		
				EG-1	:	STATUS					EXISTING		
PEAK D				129.2	kw i						_		
CONSU	MPT	TION:		412864	KWH/YR		URATION				SINGLE		
					!			or PRO-	RATELO	AD:	NA	%	
DEMAN				\$19,716	Λ'R I	LOAD LI	MIT:				100	%	
ENERG				\$9,909	AND I	DATED (<i>.</i> .			129.2	TONS	
TOTAL	UC) i :		\$29,625	WB !	RATED	CAPACITY	٠.			129.2 129.2 E		
UNIT OI	IΤΡ	UT COST:		\$229	/TONTYR		FFICIEN	CY:			1.000	KW/TON	
	_												
*		PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL	
PLANT	1	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	
DSGN			SHED	ACTUAL			ACT	ADJ	POW		ADJUST	CONSUMP	
LUAD							ACI	ALL					
%		TONS	TONS	HR/YR	kw i	TONS	%	%	*	KW	HR/YR	KWH/YR	
	w	25.8	0.0	4380	29.7	25.8	20	20	23	29.7	4380	13008	
	s	3.9	0.0	37	29.7	3.9	3	15	23	29.7	7	201	
	s	10.3	0.0	50	29.7	10.3	. 8	15	23	29.7	27	80	
	s	16.8	0.0	65	29.7	16.8	13	15	23	29.7	58	166	
	s	23.2	0.0	83	29.7	23.2 29.7	18	18 23	23	29.7 29.7	83 108	246	
	S S	29.7 36.1	0.0 0.0	106 143	29.7 29.7	29.7 36.1	23 28	23 28	23	29.7 29.7	143	3144 424	
	S	42.6	0.0	184	33.6	42.6	33	33	26	33.6	184	618	
	S	49.0	0.0	232	38.8	49.0	38	38	30	38.8	232	900	
	š	55.5	0.0	259	48.5	55.5	43	43	38	46.5	259	1204	
	š	61.9	0.0	292	54.3	61.9	48	48	42	54.3	292	1585	
	š	88.4	0.0	343	59.4	88.4	53	53	48	59.4	343	2037	
	s	74.8	0.0	381	64.6	74.8	58	58	50	64.8	381	2461	
	š	81.3	0.0	388	71.1	81,3	63	63	55	71.1	388	2758	
	š	87.7	0.0	374	77.5	87.7	68	68	60	77.5	374	2898	
73	s	94.2	0.0	357	84.0	94.2	73	73	65	84.0	357	2998	
78	s	100.6	0.0	308	91.7	100.6	78	78	71	91.7	308	2824	
83	5	107.1	0.0	247	99.5	107.1	83	83	77	99.5	247	2457	
	Ş	113.5	0.0	171	107.2	113.5	88	8.8	83	107.2	171	1833	
	s	120.0	0.0	109	116.3	120.0	93	93	90	116.3	109	1267	
	s	126.4	0.0	59	125.3	126.4	98	98	97	125.3	59	739	
	S	132.9	3.7	25	129.2	129.2	100	100	100	129.2	25	323	
	s	139.3	10.1	7	129.2	129.2	100	100	100	129.2	7	90-	
	S	145.8	16.6	2	129.2	129.2	100	100	100	129.2	2	25	
118	s	152.2	23.0	0	129.2	129.2	100	100	100	129.2	0		
				8602							8540	41286	

APPENDIX!

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

	CENT WATER PF-11 EXISTING	PARALE		% POWER ANALA RAT OCCUR POW ALLUST	% KW HRYR	0 0	0 0	000	000		00 0 0	00 0	00		00	00 0	26 46	28	68 89 88.5	22 60	76 GB (3.2	77 88.5	29	56 88 89 97.7	2
:2:				RAT RAT CAP CAP	*	000	00	00	00	9 0	00	0	00			00	8 1	70.5	94.0	22.	28	250	88	115.2	-
MASTER CHLLERNO (LAG Z):	COMPRESSOR, CONDENSER, REFRICERANT: STATUS:	CONFIGURATION: LOAD LIMIT:	RATED CAPACITY: RATED POWER:	9701	SHOT																				
				TOYD TOYD	*	88	8	8	8	8 8	8	8	8	8 8	9	- 8	8	3 8	8	8	8 8	8	8	8 8	3
				RAT POW	KW	955	911	110	=	2 2	=	1110	=		=	===	=		1110	110		100	1110	911	-
				F. S.	1046	1230	125.0	1280	280	200	1280	1280	1280	200	1230	1280	1290	200	1280	23	8 8	20	125.0	20.5	No.
		 *:	TONS	ANNUAL ENERGY CONSUMP	KWWW		-	•	-		7000	10046	12639	10206	26213	12/82	19623	16619	16179	11963	6230	2138	789	<u>8</u> -	;
\$	CENT WATER R-11 EXSTNG	PARALLE	8 21 2	ANNAL DCCUR ADJUST	HRYR		0	0	0	0 0	, ₹	22	92	8 3	38	388	374	à S	247	Ē	<u>8</u> 8	3 12	-	~ c	•
				POWER	KW	88	0	0.0	0	0 0	37.7	433	48.8	2 6	8	766	82.2	8 6	8	9	5 6 6 6	8	010	97.7	103.6
				* Pow	*			0	9		, x	2	Ŧ	8 3	8	8	4	5 5	2	8	B 2	: ::	2	88	3
MASTER CHLLERNO (LAG 1):			,	\$88¢	*			0	0		9	47	2	23 8	3 =	11	8	8 5	8	72	9 8	3 2	8	8 8	R
ROHLLER	COMPRESSOR CONDENSER. REFRICERANT: STATUS	CONFIGURATION: WIN LAG SETPONT	AATED CAPACITY:	*535	*			•	•	0 0	. 5	47	83	28 8	3 2	11	26	8 2	8	72		8 2		848	8
MASTE	COMPRE CONDEN REFRICE STATUS	CONFR	RATED CAP	200	TORS	88	38	00	8	8 6	808	682	8	200	8	98	8	70.0	4	808	3 5	105	1102	1153	1071
		# :	TOWS	WANUAL ENERGY CONSUMP	KWH//P	1069630	1220	188	2839	# F F F F F F F F F F F F F F F F F F F	9889	B614	10723	13724	22212	10152	16631	17100	13709	10123	198	1810	940	. SE	5
\$	CENT WATER R-11	PARALLE	8 2 2	ANNUAL OCCUR ADJUST	HRYR	98.	: 8	8	8	8 5	3	232	852	283	8	8	374	g g	3 2	171	<u>B</u> 8	3 2	-	~ 0	9
				POWER	KW	38.5	7.	ĸ	2	4 5	20	2	=	47.0	9	2	442	2 2	8	265	8	2	17.1	8 8	-
_		TELOAD:		RAIT FOW	×	28	2 2	27	3	÷ 8	3 3	Я	Ŧ	8 3	3 8	8	4	5 8	3	8	8 8		: 8	88	2
NO FEAD		ar PRO-Ru	1	\$\$\$₹	*	2 5	2 8	22	\$	2 8	9	47	3	2 1	3 5		_							8 8	
MASTER CHILERNO (LEAD).	COMPRESSOR: CONDENSER: REFRIGERANT: STATUS:	CONFIGURATION: MAXLEADSETPT & PROPATELOAD:	LOADLANT: RATED CAPACITY RATED POWER:	DHE *	*	4.	- 8	35	ŧ	8 8	\$ \$	4	3	21	3 5	11								81 5	
MASTE	COMPRESSOR CONDENSER: REFRIGERANT STATUS:	CONFIG	RATED CAP RATED POY	800	TONS	61.2	24.5	808	8	2.5	998	88	88	736	98	98	8	7.4.2	3	808	3 9	3 8	110.2	1153	150
	TONS			PLANT	KW	38.5	244			1 1 2				1025				181				243.4	92	2781	0.002
8 20	20 30 E	293 8	\$16,000 \$16,000 \$26,700	ANNUAL OCCUR ACTUAL	HRVIB	980	7 8	8		90 5												5.8		7	
				PLANT LOAD SHED	toks	88	9 0	8	0	0 0	3 6	9	00	00	3 6	00	00	9 6	9 0	00	9 6	9 6	; 8	0	00
9	BULDNIGNO DESIGN LOAD: WINTERLOAD SMULATION MODE.	AND:	150 H	* PLANT LOAD DSG*	TONS	61.2	24.5	9,	ŝ	2 2	8 5	1163	131 6	1469	177.8	98	1902			2003	S 162	2869	3302	3458	ž
PLANTNO	BULDNGNO DESIGN LOAD WNTERLOAD	PEAK DEMAND. CONSUMPTION	DEMAND COST ENERGY COST TOTAL COST	PLANT PLANT DSGN		1 3	0 0	9	so en	en e	n v	N O	S	SO O	n 0	0		5 5			8 i	n e	3 W	91	s

Table I-1. ECO-1 Calculation of Chiller Energy Cost for Existing Conditions

PLANT NO BUILDING DESIGN L WINTER I SIMULATI	NO: OAD:		31 87018 902 0 EQ-2S	Tons %Dsgn	COMPRE CONDEN REFRIGE STATUS:	ISER: ERANT:	NO (LE)	AD):		CENT WATER R-11 EXISTING		COMPRI CONDER REFRIGI STATUS	ISER: ERANT:	aa) on f	3 1):		CENT WATER R-11 EXISTING	
EAK DE			800.0 1657192	KWH/YR	CONFIG	JRATION:				SERIES/S	i	CONFIG	URATION				SERIES/S	
EMAND	****		\$122,080	/YR			or PRO-	RATE LO	AD:	80 100	*		SETPOR	NT:			40	%
ENERGY			\$39,773	/YR	LOADL	WIT;				100	*	LOAD LI	MIT:				100	%
TOTAL C	OST:		\$161,853	/YR 1		APACITY	/ :			436.0	TONS		CAPACIT	Y:			512.0	TONS
NIT OUT	PUT COST:		\$171	/TON"YR	RATED F		CY:			400.0 0.917	KW/TON	RATED I	POWER: EFFICIEN	CY:			400.0 0.781	KW/TON
<u> </u>	PLANT	PLANT	ANNUAL	PLANT I	CHIL	*	*	%	POWER	ANNUAL	ANNUAL I	CHIL			×.	POWER	ANNUAL	ANNUAL
TANE	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT	ronen	OCCUR	ENERGY	LOAD	PAT	RAT	RAT	FOWER	OCCUR	ENERGY
SGN		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSUM
OAD.				1		ACT	ADJ				!		ACT	ADJ				
6	TONS	TONS	HAYR	ĸw	TONS	%	%	%	KW	HRYR	KWHYR	TONS	%	%	%	ĸw	HRYR	KWHYR
0 W		0.0	4380	0.0	0.0	0	0	0	0.0	0	0 1	0.0	0	0	0	0.0	0	
3 S		0.0	37	104.0	27.1	6	15	26	104.0	15	1560	0.0	0	0	0	0.0	0	
8 S	72.2	0.0	50	104.0	72.2	17 27	17	26	104.0	50	5200	0.0	0	0	0	0.0	0	
13 S		0.0 0.0	65 83	104.0 124.0	117,3 182,4	37	27 37	26 31	104.0 124.0	65 83	6760 10292	0.0	0	0	0	0.0	0	
23 S		0.0	108	160.0	207.5	48	48	40	160.0	108	16960	0.0			ŏ	0.0	0	
28 S		0.0	143	196.0	252.6	58	58	49	196.0	143	28028	0.0	ŏ	ŏ	ŏ	0.0	ŏ	
33 5	297.7	0.0	184	236.0	297.7	68	68	59	236.0	184	43424	0.0	ō	ō	ō	0.0	ō	
38 S		0.0	232	284.0	342.8	79	79	71	284.0	232	65888	0.0	0	0	0	0.0	0	
43 5 48 S		0.0 3.0	259	276.0 308.0	183.1 228.2	42 52	42 52	35	140.0	259 292	36260	204.8	40	40	34	136.0	259	352
48 S 53 S		0.0	292 343	352.0	273.3	83	63	43 54	172.0 216.0	343	50224 74088	204.8	40	40	34	136.0 136.0	292 343	3971
58 S		0.0	381	392.0	318.4	73	73	64	256.0	381	97536	204.8	40	40	34	136.0	381	518
63 S		0.0	388	404.0	209.9	48	48	40	160.0	388	62080	358.4	70	70	61	244.0	388	9467
68 S		0.0	374	440.0	255.0	58	58	49	198.0	374	73304	358.4	70	70	61	244.0	374	9125
73 5		0.0	357	484.0	300.1	69	89	60	240.0	357	85880	358.4	70	70	61	244.0	357	8710
78 S		0.0	308	528.0	345.2	79	79	71	284.0	308	87472	358.4	70	70	61	244.0	308	7515
83 5	748.7	0.0	247	580.0	236.7	54	54 65	45	180.0	247	44460 1	512.0	100	100	100	400.0	247	9880
88 S 93 S		0.0	171 109	624.0 664.0	281.8 326.9	85 75	75	56 88	224.0	171 109	38304 28776	512.0 512.0	100 100	100	100 100	400.0	171	6840
98 S		0.0	59	712.0	372.0	85	85	78	312.0	59	18408	512.0	100	100	100	400.0	59	4360 2360
103 S		0.0	25	772.0	417.1	96	96	93	372.0	25	9300	512.0	100	100	100	400.0	25	1000
108 S		26.2	7	800.0	436.0	100	100	100	400.0	7	2800	512.0	100	100	100	400.0	7	280
113 5		71.3	2	800.0	438.0	100	100	100	400.0	2	800	512.0	100	100	100	400.0	2	80
118 S	1084.4	116.4	0	800.0	436.0	100	100	100	400.0	0	0	512.0	100	100	100	400.0	0	
			8602	i						4200	887604						3322	76958

PLANT				32	Į.	MASTER	CHILLER	NO (LE	AD):		49	
BUILD				91001	!							
DESIG				123	TONS	COMPRI					RECIP	
WINTE				0	%DSGN	CONDE					AIR	•
SIMUL	ATIC	ON MODEL:		EQ-1		REFRIG					R-22 EXISTING	
PEAK I	DEV	AND:		121.8	KW i	3.7.00					EXMINO	
CONSI	JMP	TION:		269948	KWH/YR		URATION				SINGLE	
				***	!		DSETPI	or PRO-	RATELO	AD:	NA	%
DEMAI				\$18,587	NR I	LOAD L	MIT:				100	%
ENER(\$8,479	AN I	04770						Tour
IUIAL		151:		\$25,065	MR !	RATED	CAPACITY	r:			121.8	TONS
UNIT C	UTI	PUT COST:		\$206	/TON°YR		EFFICIEN	CY:			121.8 E 1.000	KW/TON
*		PLANT	PLANT	ANNUAL	PLANT I	CHIL		*	%	POWER	ANNUAL	ANNUAL
PLANT		LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	BAT	- OHEN	OCCUR	ENERGY
DSGN			SHED	ACTUAL	52.040	LUND	CAP	CAP	POW		ADJUST	CONSUME
OAD			GILD	AOTOAL			ACT	ADJ	, , , ,		AD031	001400MI
%		TONS	TONS	HRYR	kw	TONS	%	%	%	KW	HRYR	KWHYR
	w	0.0	0.0	4380	0.0	0.0	0		0	0.0	0	
3	s	3.7	0.0	37	28.0	3.7	3	15	23	28.0	7	19
8	S	9.8	0.0	50	28.0	9.8	8	15	23	28.0	27	75
13	S	16.0	0.0	65	28.0	18.0	13	15	23	28.0	58	158
18	S	22.1	0.0	83	28.0	22.1	18	18	23	28.0	83	232
23		28.3	0.0	106	28.0	28,3	23	23	23	28.0	108	296
28	S	34.4	0.0	143	28.0	34.4	28	28	23	28.0	143	400
33	s	40.6	0.0	184	31.7	40.6	33	33	26	31.7	184	583
38		46.7	0.0	232	36.5	46.7	38	38	30	36.5	232	846
43	s	52.9	0.0	259	43.8	52.9	43	43	38	43.8	259	1134
48		59.0	0.0	292	51.2	59.0	48	48	42	51.2	292	1495
53	S	65.2	0.0	343	57.2	65.2	54	54	47	57.2	343	1962
58	S	71.3	0.0	381	62.1	71.3	59	59	51	62.1	381	2388
63	S	77.5	0.0	388	68.2	77.5	64	64	58	68.2	388	2646
68	S	83.6	0.0	374	74.3	83.6	69	69	61	74.3	374	2778
73	s	89.8	0.0	357	80.4	89.8	74	74	66	80.4	357	2870
78	s	95.9	0.0	308	87.7	95.9	79	79	72	87.7	308	2701
83	5	102.1	0.0	247	95.0	102.1	84	84	78	95.0	247	2346
88	S	108.2	0.0	171	102.3	108.2	89	89	84	102.3	171	1749
93	S	114.4	0.0	109	110.8	114.4	94	94	91	110.8	109	1207
98		120.5	0.0	59	120.6	120.5	99	99	99	120.6	59	711
	S	126.7	4.9	25	121.8	121.8	100	100	100	121.8	25	304
108		132.8	11.0	7	121.8	121.8	100	100	100	121.8	7	850
113		139.0	17.2	2	121.8	121.8	100	100	100	121.8	2	24
118	5	145.1	23.3	0	121.8	121.8	100	100	100	121.8	0	
				8602	i						4160	269948

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT NO: BUILDING NO: DESIGN LOAD: WINTER LOAD:			1 121 138 0	TONS	COMPRE CONDEN	SSOR:	NO (LE	υ γ.		CENT	
SIMULATION MO	XDEL:		EQ-1		REFRIGE STATUS:	RANT:				R-123 NEW	
PEAK DEMAND: CONSUMPTION:			91.8 196855 \$14,009	KWHYR	CONFIGU MAX LEA LOAD LIN	D SETPT	or PRO-I	RATE LOA	ND:	SINGLE NA 100	* *
DEMAND COST: ENERGY COST: TOTAL COST:			\$4,725 \$18,733	AN I	RATED C	APACITY				138.0 91.8	TONS KW
UNIT OUTPUT C	:OST:		\$136	/TONTYR	PATED E					0.665	KW/TON
X. PLAN PLANT LOAI DSGN LOAD		PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	% RAT CAP ACT	RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
ton:	s	TONS	HR/YR	KW	TONS	%	*	*	KW	HR/YR	KWHYR
	0.0	0.0	4380 37	0.0 23.9	0.0 4.1	0	0 30	0 26	0.0 23.9	0	96
8 5 1	4.1 11.0	0.0	50	23.9	11.0	8	30	26	23.9	13	311 669
	17.9 24.8	0.0 0.0	65 83	23.9	17.9 24.8	13 18	30 30	26 26	23.9 23.9	28 50	1195
	1.7	0.0	106	23.9	31.7	23	30	26	23.9	81	1936
	8.8	0.0	143 184	23.9 25.7	38.6 45.5	28 33	30 33	26 28	23.9 25.7	133 184	3179 4729
	15.5 52.4	0.0 0.0	232	29.4	52.4	38	38	32	29.4	232	6821
43 5 5	9.3	0.0	259	33.0	59.3	43	43 48	36 40	33.0 38.7	259 292	8547 10716
	36.2 73.1	0.0	292 343	36.7 40,4	66.2 73.1	48 53	53	44	40.4	343	13857
58 S 8	90.0	0.0	381	45.0	80.0	58	58	49	45.0	381	17145
	38.9	0.0 0.0	388 374	49.8 54.2	86.9 93.8	63 68	63 68	54 59	49.8 54.2	388 374	19245 20271
	23.8 00.7	0.0	357	58.8	100.7	73	73	64	58.8	357	20992
78 S 10	7.6	0.0	308 247	64.3 69.8	107.6 114.5	78 83	78 83	70 76	64.3 69.8	308	19804 17241
	14.5 21.4	0.0	171	75.3	121.4	88	88	82	75.3	171	12876
93 S 12	28.3	0.0	109	81.7	128.3	93	93	89 96	81.7 88.1	109 59	8905 5198
	35.2 42.1	0.0 4.1	59 25	88.1 91.8	135.2 138.0	98 100	98 100	100	91.8	25	2295
108 S 14	49.0	11.0	7	91.8	138.0	100	100	100	91.8 91.8	7 2	643 184
	55.9 82.8	17.9 24.8	2 0	91.8 91.8	138.0 138.0	100 100	100	100 100	91.8	ő	0
										4047	198855
			8802	:							
						CHILLER	NO 4 E				
PLANT NO: BUILDING NO:			135		MASIER	CHILLER	NO (CE				
DESIGN LOAD:			91	TONS *LDSGN	COMPRI					RECIP	
WINTER LOAD: SIMULATION M			EQ-1	76LOGN	REFRIG					R-22	
				KW .	STATUS	:				NEW	
PEAK DEMAND CONSUMPTION			77.1 188771	KWHYR		URATION				SINGLE	
				A/D		D SETPT	or PRO-	RATE LO	AD:	NA 100	%
DEMAND COST ENERGY COST			\$11,765 \$4,003	AND AND AND AND AND AND AND AND AND AND	LOADLI	MIII:				100	~
TOTAL COST:			\$15,768	MR		CAPACITY	/ :			91.0	TONS
UNIT OUTPUT	∞sT:		\$173	/TON"YR	RATED I	POWER: EFFICIEN	CY:			77.1 0.847	KW/TON
	NT -	PLANT	ANNUAL		CHIL		*	%	POWER	ANNUAL	ANNUAL
% PLA				PLANT	CHIL	%				OCCUR	ENERGY
PLANT LOA		LOAD	OCCUR ACTUAL	DEMAND	LOAD	RAT GAP ACT	RAT CAP ADJ	POW		ADJUST	CONSUMP
PLANT LOA	AD.	LOAD				RAT CAP	CAP		ĸw		KWH/YR
PLANT LOADSGN LOAD TON	4S	TONS	HR/YR 4380	KW 0.0	LOAD TONS	RAT CAP ACT	CAP ADJ	*	0.0	HR/YR	KWH/YR
PLANT LOADSGN LOAD ** TON	0.0 2.7	LOAD SHED TONS	HR/YR 4380 37	0.0 17.7	LOAD TONS 0.0 2.7	RAT CAP ACT	CAP ADJ	*		ADJUST HR/YR	KWH/YR
PLANT LOAD SGN LOAD W TON 3 S S 13 S	0.0 2.7 7.3	TONS 0.0 0.0 0.0 0.0 0.0	HR/YR 4380 37 50 65	0.0 17.7 17.7	10AD TONS 0.0 2.7 7.3 11.8	RAT CAP ACT % 0 3 8 13	CAP ADJ % 0 30 30 30	* ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° ° °	0.0 17.7 17.7 17.7	HR/YR 0 4 13 28	0 71 230 496
PLANT LOADSGN LOAD * TON	0.0 2.7 7.3 11.8 16.4	TONS 0.0 0.0 0.0 0.0 0.0 0.0	ACTUAL HR/YR 4380 37 50 65 83	0.0 17.7 17.7 17.7 17.7	LOAD TONS 0.0 2.7 7.3	RAT CAP ACT % 0 3 8 13 18	CAP ADJ % 0 30 30	% 	0.0 17.7 17.7	HR/YR 0 4 13	KWH/YR 0 71 230
PLANT LOAD SGN LOAD * TON 3 5 8 5 13 5 18 5 23 5 28 5	0.0 2.7 7.3 11.8 16.4 20.9 25.5	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 65 83 106 143	0.0 17.7 17.7 17.7 17.7 17.7 17.7	10AD 0.0 0.0 2.7 7.3 11.8 16.4 20.9 25.5	RAT CAP ACT % 0 3 8 13 18 23 28	CAP ADJ % 0 30 30 30 30 30 30 30	Pow % 23 23 23 23 23 23 23 23 23 23 23 23 23	0.0 17.7 17.7 17.7 17.7 17.7 17.7	HR/YR 0 4 13 28 50 81 133	0 71 230 496 885 1434 2354
PLANT LOAD SGN LOAD TON 0 W 3 S 8 S 13 S 23 S 28 S 33 S	0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 65 83 108 143 184	0.0 17.7 17.7 17.7 17.7 17.7 17.7 17.7 20.0	TONS 10.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0	RAT CAP ACT % 0 3 8 13 18 23 28 33	CAP ADJ % 0 30 30 30 30 30 30 30 30	POW % 0 23 23 23 23 23 23 25 26	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0	HR/YR 0 4 13 28 50 81	0 71 230 496 885 1434 2354 3680 5359
PLANT LOAD SGN LOAD * TON 0 W 3 S \$ \$ \$ \$ \$ 13 \$ \$ 18 \$ \$ \$ 28 \$ \$ \$ 28 \$ \$ 33 \$ \$ \$ 38 \$ \$ \$ \$ \$ 38 \$ \$ \$ \$ \$	0.0 2.7 7.3 11.8 16.4 25.5 30.0 34.6 39.1	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 65 83 108 143 184 232 259	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8	TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.6 39.1	RAT CAP ACT % 0 3 8 13 18 23 28 33 38 43	CAP ADJ % 30 30 30 30 30 30 30 30 30 30 30 30 30	% 0 23 23 23 23 23 23 23 26 30 36	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8	HR/YR 0 4 13 28 50 81 133 184 232 259	0 71 230 496 885 1434 2354 3880 5359
PLANT LOAD SQN LOAD SQN LOAD SQN SQN SQN SQN SQN SQN SQN SQN SQN SQN	0.0 2.7 7.3 11.8 16.4 20.9 25.5 34.6 34.6 34.7	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4390 37 50 85 83 108 143 184 232 259 292	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4	TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.6 39.1 43.7	RAT GAP ACT % 0 3 8 13 18 23 28 33 38 43 48	CAP ADJ % 30 30 30 30 30 30 30 30 30 30 43 43	% 0 23 23 23 23 23 26 30 36 42	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4	HR/YR 0 4 13 28 50 81 133 184 232 259 292	0 71 230 496 885 1434 2354 3880 5359
PLANT LOADSON LOADSON LOAD SON	0.0 2.7 7.3 11.8 120.9 25.5 30.0 34.6 39.1 43.7 48.2 52.8	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 65 83 106 143 184 232 259 292 343 381	0.0 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.8	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.6 39.1 49.7 48.2 55.8	RAT CAP ACT % 0 3 8 13 18 23 28 33 38 43 48 53 58	CAP ADJ % 30 30 30 30 30 30 30 30 30 30 30 30 30	POW % 0 23 23 23 23 23 23 24 26 30 36 42 48	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6	HR/YR 0 4 13 28 50 81 133 184 222 259 292 343 381	0 71 230 496 885 1434 2354 3880 5359
PLANT LOADSON LOADSON LOAD SON	0.0 2.7 11.8 16.4 20.9 25.5 34.6 39.1 43.7 48.2 55.8 57.3	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 85 83 108 143 184 232 259 292 343 381 388	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.8 39.1 49.7 48.2 57.3	RAT CAP ACT % 0 3 8 13 18 22 23 23 33 38 48 53 53 58	CAP ADJ % 30 30 30 30 30 30 30 30 30 30 30 30 30	POW % 0 23 23 23 23 23 24 30 36 42 46 500 55	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4	HR/YR 0 4 13 28 50 81 134 232 259 243 381 388	XWH/YR 0 71 230 496 885 1434 2354 3880 5359 7200 9481 12177 14707
PLANT LOADSON LOADSON LOAD SON	0.0 2.7 7.3 11.8 16.4 20.9 25.5 34.6 39.1 43.7 48.2 557.3 61.9	TONS 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.	ACTUAL HR/YR 4380 37 50 85 83 108 143 184 2332 259 292 343 381 388 374	0.0 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4 48.3	LOAD TONS 0.0 2.7 7.3 11.8 11.8 12.5 30.0 30.1 49.7 48.2 52.8 57.3 61.9	RAT CAP ACT % 0 3 8 13 18 23 28 33 38 43 48 53 58	CAP ADJ % 30 30 30 30 30 30 30 30 30 30 30 30 30	% 0 0 23 23 23 23 23 23 24 46 50 55 60 65	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4 46.3 50.1	ADJUST HR/YR 0 4 13 28 50 81 133 194 232 250 292 343 381 388 374 357	XWH/YR 0 71 230 498 885 1434 2354 3680 5359 7200 9461 12177 14707 16451 17318
PLANT LOADSON	0.0 2.7 7.3 11.8 120.9 25.5 30.0 43.7 48.7 48.2 61.9 61.9 61.9	TONS	ACTUAL HR/YR 4380 37 50 65 83 108 143 184 232 259 292 343 381 388 374 357 308	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4 48.3 50.1	LOAD TONS 2.7 7.3 11.8 16.4 20.9 22.5 30.0 34.8 39.1 43.7 48.2 57.3 61.9 68.4 71.0	RAT CAP ACT % 0 3 18 13 18 22 28 33 38 43 53 58 63 68 73 78	CAP ADJ % 30 30 30 30 30 30 30 33 38 43 48 53 68 73 78	% 0 23 23 23 23 23 24 30 36 42 46 55 60 65 71	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4 46.3 50.1 54.7	ADJUST HR/YR 0 4 13 28 50 81 133 184 222 259 292 343 381 388 388 387 374 357	XWH/YR 0 71 230 496 885 1434 2254 3880 5359 7200 9461 12177 14707 18451 17316 17986 18948
PLANT LOADSON	0.0 2.7 7.3 11.8 12.9 25.5 30.0 39.1 43.7 48.2 557.3 61.9 68.4 71.0 75.5	TONS	ACTUAL HR/YR 4380 37 50 65 83 106 61 143 184 232 259 202 343 381 381 388 374 307	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 20.1 23.1 27.8 32.4 48.3 50.1 54.7 59.4	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.6 39.1 449.7 55.8 57.3 61.9 68.4 71.0 75.5 75.5	RAT GAP ACT % 0 3 8 13 18 28 33 38 43 48 53 58 68 63 68 73	CAP ADJ % 30 30 30 30 30 30 30 30 33 38 43 48 53 63 63 63	% 0 0 23 23 23 23 23 23 24 46 50 55 60 65	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 35.5 38.6 42.4 46.3 50.1	ADJUST HR/YR 0 4 13 28 50 81 133 194 222 250 292 343 381 388 374 357	XWH/YR 0 71 230 498 855 1434 2354 3880 5359 7200 9461 121777 14707 14457 17988 18484 14672
PLANT LOAD SANT	0.0 2.7 7.3 11.8 16.4 20.9 34.6 34.6 34.7 48.2 57.3 61.9 67.0 75.5 84.6	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4390 37 50 65 83 106 61 143 184 232 259 292 243 381 388 374 377 308 247 171 109	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 20.1 27.8 32.4 48.3 50.1 54.7 59.4 64.0	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.6 34.7 43.7 48.2 52.8 57.3 61.9 68.4 75.5 80.0 75.5	RAT CAP ACT % 0 3 8 13 18 22 28 23 33 38 43 48 53 58 68 73 78 83 88	CAP ADJ % 30 30 30 30 30 30 30 33 38 43 48 53 58 68 73 78 83 83 83 83	POW % 0 23 23 23 23 23 26 30 36 48 50 65 71 77 83 90	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.8 35.5 38.8 42.8 46.3 50.1 54.7 59.8 64.0	ADJUST HR/YR 0 4 13 28 50 81 133 184 232 259 292 343 381 388 374 357 308 247 171 100	XWH/YR 70 71 200 496 885 1434 2354 3890 7200 9461 12177 1477316 17316 17866 18848 14672 10944 7586
PLANT LOAD SANT	0.0 2.7 7.3 16.4 20.9 34.6 330.0 34.6 33.0 61.9 48.7 75.5 80.1 88.2	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 65 83 106 143 124 222 259 202 234 34 343 341 357 308 247 171 109 59	0.0 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 40.3 55.5 38.6 42.4 46.3 55.1 54.7 59.4 64.0 69.4 74.8	TONS 0.0 2.7 7.3 11.8 16.4 20.9 25.5 30.0 34.8 39.1 49.7 48.2 52.8 57.3 61.9 68.4 71.0 88.4 88.4 88.8	RAT CAP ACT % 0 3 8 13 18 23 28 23 38 48 53 68 83 68 73 78 88 93 98	CAP ADJ % 30 30 30 30 30 30 30 33 33 48 43 48 53 58 68 68 73 78 88 98	POW % 0 23 23 23 23 23 23 24 46 50 55 60 65 71 77 83 90 97	0.0 17.7 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 32.4 35.5 38.6 42.4 46.3 50.1 54.7 64.0 69.4 64.0	ADJUST HR/YR 0 4 13 28 50 81 133 31 144 222 259 292 343 381 388 374 357 308 247 171 100 50	0 71 200 498 885 1434 2354 3690 9461 12177 14707 14451 17318 1848 1848 1848 1758 4413
PLANT LOAD SON LOAD S	IS 0.0 2.7 7.3 111.8 122.9 25.5 39.1 443.2 443.7 75.5 661.9 668.4 689.2 998.3	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	ACTUAL HR/YR 4380 37 50 65 83 106 143 124 232 259 292 243 341 358 388 384 277 171 100 59 25 7	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 22.1 27.8 32.4 46.3 50.1 54.7 59.4 64.0 64.6 77.1 77.1 77.1 77.7 17.7 17.7 17.7 17	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 23.0 34.8 39.1 49.7 49.7 49.7 68.4 71.0 71.0 71.0 80.1 80.1 91.0 91.0	RAT CAP ACT % 0 3 8 13 18 23 28 33 38 43 48 53 53 53 53 88 93 93 98 100 100	CAP ADJ % 30 30 30 30 30 30 30 30 33 43 43 45 58 68 73 73 73 78 83 83 83 98 100	POW % 0 23 23 23 23 23 23 24 60 65 71 77 83 99 97 100 100	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 35.5 38.6 42.4 46.3 50.1 54.7 69.4 64.0 69.4 77.1	ADJUST HR/YR 0 4 13 28 50 81 133 28 25 20 29 243 381 388 374 357 308 247 171 100 50 25 7	XWH/YR 0 71 230 498 885 1434 2354 3890 9481 12177 14707 14451 17318 1884 14672 10044 7585 4413 1928
PANT LOAD SON LOAD SO	0.0 2.7 7.3 11.8 16.4 9.2 25.5 30.0 39.1 443.7 77.5 568.4 775.5 80.1 848.2 993.7 80.2 80.2 80.2 80.2 80.2 80.2 80.2 80.2	TONS	ACTUAL HR/YR 4380 37 50 65 83 106 143 184 222 2592 343 381 388 247 171 171 109 59 25 7 2	NW 0.0 17.7 17.7 17.7 17.7 20.0 23.1 1 27.8 32.4 463.3 50.1 54.4 463.4 463.7 17.7 17.7 17.7 17.7 17.7 17.7 17.7 1	LOAD TONS 0.0 2.7 7.3 11.8 18.4 20.9 25.5 30.0 34.8 39.1 49.7 48.2 52.8 57.3 68.4 71.0 91.0 91.0	RAT CAP ACT % 0 0 3 8 13 18 23 33 38 43 43 48 53 58 63 73 88 93 98 100 100 100 100 100 100 100 100 100 10	GAP ADJ % 30 30 30 30 30 30 30 30 30 30 30 30 30	% 0 0 23 23 23 23 23 24 50 36 42 55 60 65 71 77 83 99 97 100 100 100 100 100	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 32.4 46.3 50.1 54.7 69.4 69.4 74.8 77.1 77.1	ADJUST HR/YR 0 4 13 28 50 81 133 194 222 259 243 381 388 374 357 308 247 171 100 50 57 2	XWH/YR 70 71 230 498 885 1434 2354 3890 7200 94818 12177 14707 16451 17318 17388 16452 10944 17585 4413 1928
PLANT LOADSON LOAD SON IS 0.0 2.7 7.3 111.8 122.9 25.5 39.1 443.2 443.7 75.5 661.9 668.4 689.2 998.3	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	ACTUAL HR/YR 4380 37 50 65 83 106 143 124 232 259 292 243 341 358 388 384 277 171 100 59 25 7	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 22.1 27.8 32.4 46.3 50.1 54.7 59.4 64.0 64.6 77.1 77.1 77.1 77.7 17.7 17.7 17.7 17	LOAD TONS 0.0 2.7 7.3 11.8 16.4 20.9 23.0 34.8 39.1 49.7 49.7 49.7 68.4 71.0 71.0 71.0 80.1 80.1 91.0 91.0	RAT CAP ACT % 0 3 8 13 18 23 28 33 38 43 48 53 53 53 53 88 93 93 98 100 100	CAP ADJ % 30 30 30 30 30 30 30 30 33 43 43 45 58 68 73 73 73 78 83 83 83 98 100	POW % 0 23 23 23 23 23 23 24 60 65 71 77 83 99 97 100 100	0.0 17.7 17.7 17.7 17.7 17.7 17.7 20.0 23.1 27.8 35.5 38.6 42.4 46.3 50.1 54.7 69.4 64.0 69.4 77.1	ADJUST HR/YR 0 4 13 28 50 81 133 28 25 20 29 243 381 388 374 357 308 247 171 100 50 25 7	XWH/YR 0 71 230 498 885 1434 2354 3890 9481 12177 14707 14451 17318 1884 14672 10044 7585 4413 1928	

USACERL SR 97/90

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT I				3	1	MASTER	CHILLER	NO (LE	ND):		4	
BULDIN	Ю	NO:		194	1							
DESIGN	L	DAD:		107	TONS	COMPRI					RECIP	
WINTER	L	OAD:		0	%DSGN	CONDE	ISER:				WATER	
SIMULA	TIC	ON MODEL:		EQ-1		REFRIG					R-22 NEW	
PEAK D	EM	AND:		91.5	kw i							
CONSU				197909	KWHYR		URATION		BATELO	AD:	SINGLE NA	*
DEMAN	D C	COST:		\$13,963	Λ⁄R i	LOAD LI					100	*
ENERG				\$4,750	MB i						***	
TOTAL	co	ST:		\$18,713	MB	RATED	CAPACITY	Y :			107.0 91.5	TONS
UNIT O	JTE	PUT COST:		\$175	TONYR	RATED	EFFICIEN	CY:			0.855	KW/TON
%		PLANT	PLANT	ANNUAL	PLANT	CHIL	*	%	%	POWER	ANNUAL	ANNUAL
PLANT		LOAD	LOAD	OCCUR	DEMAND	LOAD	CAP	CAP	POW		ADJUST	CONSUMP
DSGN LOAD			SHED	ACTUAL			ACT	ADJ	POW		ADJUST	CONSUMP
*		TONS	TONS	HRYR	kw	TONS	%	*	%	KW	HRYR	KWH/YR
		0.0	0.0	4380	0.0	0.0	0	o	0	0.0	0	0
	S	3.2	0.0	37	21.0	3.2	3	30	23	21.0	4	84
	s	8.6	0.0	50	21.0	8.8		30	23	21.0	13	273
	s	13.9	0.0	65	21.0	13.9	13	30	23	21.0	28	588
	\$	19.3	0.0	83	21.0	19.3	18	30	23	21.0	50	1050
	s	24.6	0.0	108	21.0	24.8	23	30	23	21.0	81	1701
	s	30.0	0.0	143	21.0	30.0	28	30	23	21.0	133	2793
	Ş	35.3	0.0	184	23.8	35.3	33	33	26	23.8	184	4379
	s	40.7	0.0	232	27.5	40.7	38	38	30	27.5	232	6380
	s	46.0	0.0	259	32.9	46.0	43	43	36	32.9	259	8521
	Ş	51.4	0.0	292	38.4	51.4	48	48	42	38.4	292	11213
	s	56.7	0.0	343	42.1	56.7	53	53	46	42.1	343	14440
	ş	62.1	0.0	381	45.8	62.1	58	58	50	45.8	381	17450
	ş	67.4	0.0	388	50.3	87.4	63	63 88	55	50.3	388	19516
	s	72.8	0.0	374	54.9	72.8	68		60	54.9	374	20533
	s	78.1 83.5	0.0	357 308	59.5 65.0	78.1 83.5	73 78	73 78	85 71	59.5 65.0	357 308	21242
	S	88.8	0.0	247	70.5	88.8	83	83	77	70.5	247	17414
	5	94.2	0.0	171	70.5 75.9	94.2	88	83 88	83	75.9	171	12979
	s	99.5	0.0	109	82.4	99.5	93	93	90	82.4	109	8982
	S	104.9	0.0	59	88.8	104.9	98	98	97	88.8	59	5239
	S	110.2	3.2	25	91.5	107.0	100	100	100	91.5	25	2288
	s	115.6	8.6	7	91.5	107.0	100	100	100	91.5	7	841
	s	120.9	13.9	2	91.5	107.0	100	100	100	91.5	2	183
118		126.3	19.3	ō	91.5	107.0	100	100	100	91.5	ō	0
				8602							4047	197909

PLANT NO			5 410		MASTER	CHILLER	NO (LE	AD):		6	!	MASTER	CHILLE	NO (LA	3 1):		7	
DESIGN L			238	TONS	COMPRI	ESSOR:				CENT	í	COMPR	ESSOR:				CENT	
WINTER	LOAD:		0	%DSGN I	CONDE	SER:				WATER	i	CONDE	WSER:				WATER	
SIMULATI	ON MODEL	:	EQ-2M		REFRIG	ERANT:				R-123	i	REFRIG	ERANT:				R-123	
PEAK DE	4410-		163.8		STATUS	:				NEW	į	STATUS	i:				NEW	
CONSUM			351549	KWHYR	CONEIG	URATION				PARALLE	, ;	CONIETO	URATION	ta.			PARALLE	-
CONSUM	FICH.		331349	KINDUR I				RATELO	AD:	80	%		SETPO				NA NA	*
DEMAND	COST:		\$24,996	ΛΉR	LOAD L					100	%	LOAD L		• • • •			100	%
ENERGY			\$8,437	MB														
TOTAL CO	OST:		\$33,433	A/R	RATED	CAPACIT	Y:			119.0	TONS I	RATED	CAPACIT	Y:			119.0	TONS
				i	RATEDI	POWER:				81.9	KW i	RATED	POWER:				81.9	KW
UNIT OUT	PUT COST:		\$140	/TONYR	RATED E	EFFICIEN	CY:			0.688	KW/TON	RATED	EFFICIEN	CY:			0.688	KW/TON
*	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL	CHIL	%	%	%	POWER	ANNUAL	ANNUAL!
PLANT	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	TAR		OCCUR	ENERGY	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
DSGN		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSUM
OAD						ACT	ADJ				!		ACT	ADJ				
4	TONS	TONS	HR/YR	KW	TONS	%	%	%	KW	HR/YR	KWHYR	TONS	%	%	%	ĸw	HR/YR	KWHYR
0 W	0.0	0.0	4380	0.0	0.0	0	0	0	0.0	0	0 1	0.0	0	0	0	0.0	0	
3 S	7.1	0.0	37	21.3	7.1	6	30	26	21.3	7	149	0.0	0	0	0	0.0	0	
8 S	19.0	0.0	50	21.3	19.0	16	30	26	21.3	27	575	0.0	0	0	0	0.0	0	
13 S	30.9	0.0	65	21.3	30.9	26	30	26	21.3	56	1193	0.0	0	0	0	0.0	0	
18 S 23 S	42.8 54.7	0.0	83 108	24.8	42.8 54.7	36 46	38 46	30 38	24.6 31.1	83 108	2042 3297	0.0	0	U	0	0.0	0	
28 S	66.6	0.0	143	38.5	66.6	56	56	47	38.5	143	5508	0.0	V	ŭ	0	0.0		
33 S	78.5	0.0	184	46.7	78.5	56 68	56	57	46.7	184	8593 I	0.0	V	ŭ	ŭ	0.0		
38 S	90.4	0.0	232	55.7	90.4	76	76	68	55.7	232	12922	0.0	ŏ	n	ő	0.0	0	
43 S	102.3	0.0	259	59.0	51.2	43	43	36	29.5	259	7841	51.1	43	43	38	29.5	259	76
48 S	114.2	0.0	292	65.8	57.1	48	48	40	32.8	292	9578	57.1	48	48	40	32.8	292	95
53 S	126.1	0.0	343	72.0	63.1	53	53	44	36.0	343	12348	63.0	53	53	44	36.0	343	123
58 S	138.0	0.0	381	80.2	89.0	58	58	49	40.1	381	15278	69.0	58	58	49	40.1	381	152
63 S	149.9	0.0	388	88.4	75.0	63	63	54	44.2	388	17150	74.9	63	63	54	44.2	388	171
68 S	161.8	0.0	374	96.6	80.9	68	68	59	48.3	374	18064	80.9	68	68	59	48.3	374	180
73 \$	173.7	0.0	357	104.8	86.9	73	73	64	52.4	357	18707	86.8	73	73	64	52.4	357	187
78 S	185.6	0.0	308	114.6	92.8	78	78	70	57.3	308	17648	92.8	78	78	70	57.3	308	176
83 S	197.5	0.0	247	124.4	98.8	83	83	78	62.2	247	15363	98.7	83	83	76	62.2	247	153
88 S	209.4	0.0	171	134.4	104.7	88	88	82	87.2	171	11491	104.7	88	88	82	67.2	171	114
93 S	221.3	0.0	109 59	145.8 157.2	110.7 116.6	93	93 98	89 98	72.9 78.6	109 59	7946 4637	110.6 118.6	93 98	93	89	72.9	109	79
103 5	245.1	7.1	25	163.8	119.0	100	100	100	81.9	25	2048	119.0	100	98 100	98	78.6	59 25	46
108 5	257.0	19.0	7	163.8	119.0	100	100	100	81.9	7	573	119.0	100	100	100	81.9 81.9	7	20. 5
113 5	268.9	30.9	2	163.8	119.0	100	100	100	81.9	é	164	119.0	100	100	100	81.9	2	1
118 S	280.8	42.8	0	163.8	119.0	100	100	100	81.9	ő	0 1	119.0	100	100	100	81.9	0	11
											i							
			8602	1						4160	192913						3322	1586

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

LANT NO:			6 2805	1	MASTER	CHILLER	NO (LEA	D):		8	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO	00EL:		116 0 EQ-1	TONS %DSGN	COMPRE CONDENS REFRIGE STATUS;	SER:				RECIP WATER R-22 NEW	
PEAK DEMAND: CONSUMPTION	:		99.6 215406 \$15,199	KW KWHYR YR	CONFIGU MAX LEA LOAD LIN	DSETPT	or PRO-I	RATE LOA	ND:	SINGLE NA 100	% %
DEMAND COST: ENERGY COST: FOTAL COST:			\$5,170 \$20,369	A/R A/R	RATED C	APACITY	:			116.0 99.6	TONS KW
UNIT OUTPUT C	OST:		\$176	/TONTYR	RATED E		Y: 			0.859	KW/TON
K PLAJ PLANT LOAI DSGN LOAD		PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
% TON	s	TONS	HRYR	ĸw	TONS	%	%	%	KW	HR/YR	KWHYR
8 S 13 S 1 18 S 2	0.0 3.5 9.3 15.1 20.9 26.7	0.0 0.0 0.0 0.0 0.0	4380 37 50 65 83 106	0.0 22.9 22.9 22.9 22.9 22.9	0.0 3.5 9.3 15.1 20.9 26.7	0 3 8 13 18 23	30 30 30 30 30	**************************************	0.0 22.9 22.9 22.9 22.9 22.9	0 4 13 28 50 81	0 92 298 641 1145 1855
	32.5 38.3	0.0	143	22.9 25.9	32.5 38.3	28 33	30 33	23 26	22.9 25.9	133	3048 4768
34 \$	44.1 49.9	0.0	232 259	29.9 35.9	44.1 49.9	38 43	38 43	30 36	29.9 35.9	232 259	6937 9298
44 S	55.7 81.5	0.0	292 343	41.8 45.8	55.7 61.5	46 53	48 53	42	41.8	292 343	12206 15709
58 S	87.3 73.1	0.0	391 388	49.8 54.8	67.3 73.1	58 63	58 63	50 55	49.8 54.8	381 388	18974 21262
88 5	78.9	0.0	374 357	59.8 64.7	78.9 84.7	68 73	68 73	60 65	59.8 64.7	374 357	22365 23098
78 5	84.7 90.5	0.0	308	70.7	90.5	78 83	78 83	71 77	70.7 76.7	308 247	21776 18945
	96.3 02.1	0.0	247 171	76.7 82.7	96.3 102.1	88	88	83	82.7	171	14142
	07.9 13.7	0.0	109 59	89.6 96.6	107.9	93 98	93 98	90 97	89.6 96.6	109 59	5899
103 5 1	19.5 25.3	3.5 9.3	25 7	99.8 99.8	116.0 116.0	100 100	100 100	100 100	99.6	25 7	2490 897
113 S 13	31.1 36.9	15.1	2	99.8	116.0	100	100	100	99.6 99.6	2	199
110 5 1	30.9	20.0	8602							4047	215408
					<u></u>						
PLANT NO:			7		MASTER	CHILLER	NO ILE	AD):			
BUILDING NO:			5764 201 E	E TONS	COMPR					CENT	
WINTER LOAD: SIMULATION M	:		EQ-1	%D6GN	CONDEN REFRIG	NSER: ERANT:				WATER R-123 NEW	
PEAK DEMAND CONSUMPTION	4 :		136.8 293284 \$20,876	KW KWHYR YR		URATION AD SETPI		RATELO	AD:	SINGLE NA 100	% %
DEMAND COST ENERGY COST TOTAL COST:			\$7,039 \$27,914	A/R	RATED	CAPACITY POWER:				201.0 136.8	TONS KW
UNIT OUTPUT	COST:		\$139	/TON"YR		EFFICIEN				0.681	KW/TON
% PLA PLANT LOA DSGN LOAD		PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	% RAT CAP ACT	RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
% TO	NS	TONS	HR/YR	KW	TONS	*	*	<u>*</u>	KW .	HR/YR	KWH/YR
0 W	0.0 6.0	0.0	4380 37	0.0 35.6	0.0	0	30	0 26	0.0 35,6	0	142
3 S 8 S 13 S	16.1	0.0	50 85	35.6 35.6	18.1	8	30 30	26 28	35.6 35.6	13 28	463
18 S	26.1 36.2	0.0	83	35.6	36.2	18	30	26	35.6	50	1780
23 S 28 S 33 S	48.2 58.3	0.0	108 143	35.6 35.6	56.3	23 28	30 30	26 26	35.6 38.3	133 184	4738 7047
38 S	66.3 76.4	0.0 0.0	184 232	38.3 43.8	68.3 78.4	33 38	33 38	28 32	43.8	232	10162
43 S 48 S	88.4 96.5	0.0 0.0	259 292	49.2 54.7	86.4 96.5	43 48	43 48	38 40	49.2 54.7	259 292	12743 15972
53 S 1	108.5 116.6	0.0	343 381	60.2 67.0	108.5	53 58	53 58	49	60.2 67.0	343 381	20849 2552
63 S 1	126.6	0.0	388 374	73.9 80.7	126.6 138.7	63 68	63 68	54 59	73.9 80.7	388 374	28673 3018
73 S 1	138.7 148.7	0.0	357	87.6	146.7	73	73	64 70	87.6 95.8	357 308	3127 2950
83 S	158.8 166.8	0.0 0.0	308 247	95.8 104.0	156.8 166.8	78 83	78 83	76	104.0	247	2568
88 5	176.9 186.9	0.0	171 109	112.2 121.8	176.9	88 93	88 93	82 89	112.2 121.8	171 109	1918 1327
98 S	197.0 207.0	0.0 6.0	59 25	131.3 136.8	197.0	98 100	98 100	96 100	131.3	59 25	774 342
103 5 4		16.1	7	136.8	201.0	100	100	100	138.8	7	95
108 5	217.1			128 9	1 201.0	100	100	100	1368	2	27
108 S 2	217.1 227.1 237.2	26.1 36.2	2	136.8 136.8	201.0	100 100	100 100	100 100	136.8 136.8	0	27

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

DESIGN LOAD: WATER LOAD: 0 %DSGN COMPRESSOR: WATER REPRIGERANT: REPRIGERANT: NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW	PLANT N					MASTER	CHILLE	NO (LE	AD):		- 11	
WATER MATER SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: CONSUMPTION: DEMAND: DEMAND: CONSUMPTION: STATUS: CONFIGURATION: MAX LEAD SEPT or PRO-RATE LOAD: NA X- LOAD LMIT: 100 X- BNERGY COST: 132 WINTT OUTPUT COST: \$137 // NR RATED CAPACITY: RATED CAPACITY: RATED DEMAND COCUR DEMAND LOAD RAT RAT RAT RAT CAP CAP POW ACTER DEMAND COCUR				5792								
SIMULATION MODEL: 113.2 KW CONFIGURATION: STATUS: NEW PLANT CONSUMAPTION: 253789 KWHYR CONFIGURATION: MAX LEAD SETPT or PRO-RATE LOAD: NA												
PEAX DBMAND: 1132 KW 253789 KWH/YR 3789 KWH/YR 253789 KWH/YR	WINTER	LOAD:		0	%DSGN	CONDE	NSER:				WATER	
PEAK DBAMND: 253789	SIMULAT	TON MODE	<u>.</u>	EQ-1	i							
DEMAND COST: ENERGY COST: S8,091 VR 423,385 VR RATED CAPACITY: RATED POWER: RATED P												
DEMAND COST:	CONSUM	APTION:		253789	KWH/YR (RATELO	AD:		*
ENERGY COST: \$23,385 \ \text{ /R } RATED CAPACITY: RATED POWER: \$113.2 \ \text{ KW} RATED CAPACITY: \$13.2 \	DEMAND	COST:		\$17,274	Λ⁄R i							
UNIT OUTPUT COST: \$137 / ITON'YR RATED POWER: 0.866 KW/TON ** PLANT PLANT LOAD LOAD CCUR DEWND LOAD RAT RAT RAT COCCUR ENERGY ADJUST CONSUMI LOAD LOAD CCUR DEWND LOAD ACT ADJ ** TONS TONS HRYR KW TONS * * * * * * * * * * * * * * * * * * *	ENERGY	COST:		\$6,091	A/R i							
UNIT OUTPUT COST: \$ 137	TOTAL C	OST:		\$23,365	ΛΉ			/ :				
DEMAND LOAD LOAD COCUR DEMAND LOAD RAT RAT RAT RAT COCUR ENERGY ACTUAL CONSUMI	UNIT OU	TPUT COST	:	\$137	TONYR			CY:				
DSGN LOAD TONS TONS HRYR KW TONS % % KW HRYR KWHYR KWHYR % KWHYR KWHYR KWHYR % KWHYR KWHYR % KWHYR KWHYR % KWHYR % KWHYR KWHYR % % KWHYR % KWHYR % % KWHYR % KWHYR % % % % KWHYR % % % KWHYR % % % % KWHYR % % % % % % % % %								*		POWER	ANNUAL	ANNUAL
COAD	PLANT	LOAD			DEWAND	LOAD		RAT				ENERGY
TONS TONS HRYR KW TONS % % KW HRYR KWHYR 0 W 0.0 0.0 4340 0.0 0.0 0 0 0 0.0 0 3 S 5.3 0.0 37 29.4 5.3 3 30 28 29.4 4 11 8 S 14.1 0.0 50 29.4 12.1 8 30 26 29.4 13 38 13 S 22.9 0.0 65 29.4 12.2 13 30 26 29.4 28 82 18 S 31.7 0.0 83 29.4 131.7 19 30 26 29.4 53 155 23 S 40.5 0.0 106 29.4 14.1 8 30 26 29.4 53 155 23 S 40.5 0.0 106 29.4 140.5 24 30 26 29.4 55 155 23 S 40.5 0.0 106 29.4 140.5 24 30 26 29.4 45 24 28 S 49.3 0.0 143 29.4 149.3 29 30 26 29.4 13 45 23 S 58.1 0.0 154 32.8 58.1 34 34 29 32.8 184 603 34 S 58.1 0.0 154 32.8 58.1 34 34 29 32.8 184 603 34 S 68.9 0.0 222 37.4 68.9 39 39 33 37.4 222 867 43 S 75.7 0.0 259 43.0 75.7 45 45 38 43.0 259 1113 48 S 84.5 0.0 252 47.5 84.5 50 50 42 47.5 292 1367 58 S 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 1285 63 S 110.9 0.0 388 63.4 110.9 65 85 56 63.4 388 2459 63 S 110.9 0.0 388 63.4 110.9 65 85 56 63.4 388 2459 63 S 110.7 0.0 374 88.1 110.7 70 61 60.1 374 2584 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2784 73 S 128.5 0.0 357 77.0 100 100 100 100 113.2 59 667 79 S 187.2 2.5 59 113.2 170.0 100 100 100 113.2 77 79.1 103 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 77 79.1 113 S 188.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 7 79.1 113 S 188.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 22 118 S 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2 22 118 S 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2			SHED	ACTUAL	1				POW		ADJUST	CONSUMP
0 W 0.0 0.0 4380 0.0 0.0 0.0 0 0 0 0.0 0 0 0 0 0 0 0 0	LOAD						ACT	ADJ				
3 S 53 0.0 37 294 5.3 3 30 28 294 4 11 8 S 14.1 0.0 50 294 12.9 13 30 28 29.4 13 38 13 S 22.9 0.0 85 294 22.9 13 30 28 29.4 28 82 18 S 31.7 0.0 83 294 31.7 19 30 28 29.4 53 155 23 S 40.5 0.0 108 294 40.5 24 30 28 29.4 45 249 28 S 49.3 0.0 143 29.4 40.5 24 30 28 29.4 485 249 28 S 49.3 0.0 143 29.4 40.5 24 30 28 29.4 138 405 23 S 40.5 0.0 108 29.4 40.5 29 30 28 29.4 138 40.5 33 S 58.1 0.0 184 32.8 58.1 34 34 29 32.8 184 60.3 34 S 86.9 0.0 222 37.4 68.9 39 39 33 37.4 222 887 43 S 75.7 0.0 259 43.0 75.7 45 45 38 42.0 259 1113 48 S 84.5 0.0 292 47.5 84.5 50 50 42 47.5 292 187 53 S 93.3 0.0 343 52.1 93.3 55 55 48 52.1 343 177.7 58 S 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 2188 63 S 110.9 0.0 388 69.4 110.9 65 68 55 68.4 388 2459 68 S 119.7 0.0 374 89.1 119.7 70 70 61 69.1 374 2584 73 S 128.5 0.0 357 77.0 128.5 76 78 68 77.0 357 2748 83 S 146.1 0.0 247 90.8 148.1 88 88 80 90.8 247 228 83 S 146.1 0.0 247 90.8 148.1 88 88 80 90.8 247 228 84 S 154.9 0.0 171 171 170 100 100 100 100 113.2 59 677 103 S 183.3 11.3 25 113.2 170.0 100 100 100 113.2 59 677 103 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 7 79.1 113.2 118.8 198.9 28.9 28.9 28.9 28.9 28.9 28.9 28.9	*	TONS	TONS	HR/YR	ĸw	TONS	%	%	*	KW	HR/YR	KWHYR
8 S 14.1 0.0 50 29.4 14.1 8 30 28 29.4 13 38 13 13 S 22.9 0.0 85 29.4 22.9 13 30 28 29.4 28 82 18 S 31.7 0.0 83 29.4 31.7 19 30 28 29.4 28 82 18 S 31.7 0.0 83 29.4 31.7 19 30 28 29.4 53 185 23 S 40.5 0.0 108 29.4 40.5 24 30 28 29.4 85 24.9 185 28 S 49.3 0.0 143 29.4 40.3 29 30 28 29.4 138 40.5 33 S 58.1 0.0 184 32.8 58.1 34 34 29 32.8 19.4 80.3 34 S 86.9 0.0 222 37.4 86.9 39 39 33 37.4 222 887 43 S 75.7 0.0 229 43.0 75.7 45 45 38 43.0 259 1113 5 84.5 0.0 292 47.5 84.5 50 50 42 47.5 292 1387 53 S 93.3 0.0 343 52.1 93.3 55 55 48 82.1 94.5 29.4 138 83 84.5 0.0 292 47.5 84.5 50 50 42 47.5 292 1387 58 S 102.1 0.0 381 57.7 102.1 60 80 51 57.7 381 2188 83 S 110.9 0.0 388 83.4 110.9 65 85 56 83.4 388 2459 88.5 110.7 0.0 374 89.1 110.9 65 85 56 83.4 388 2459 88.5 110.7 0.0 374 89.1 110.9 65 85 56 83.4 388 2459 88.5 110.7 0.0 374 89.1 110.9 70 70 61 80.1 374 258.4 73 S 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2748 83 S 146.1 0.0 247 90.6 146.1 88 88 80 0.8 247 227.4 88.5 110.7 0.0 374 89.1 110.9 70 70 61 80.1 374 258.4 83 137.3 81 83 S 146.1 0.0 247 90.6 146.1 88 88 80 0.8 247 27.4 90.6 146.1 88 88 80 0.8 247 227.7 88 S 154.9 0.0 171 171 171 186.5 154.9 91 91 88 97.4 171 186.5 163 S 163.7 0.0 100 105.2 163.7 98 96 83 105.3 105.3 105 113.2 5 113.2 170.0 100 100 100 113.2 5 98 86.7 103 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 7 79.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 7 79.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 100 113.2 2 5 28.1 113 S 198.9 28.9 28.9 2 113.2 170.0 100 100 100 100 113.2 2												(
13 S 22.9 0.0 85 29.4 22.9 13 30 28 29.4 28 82 18 S 31.7 0.0 83 29.4 31.7 19 30 28 29.4 53 155 23 S 40.5 0.0 108 29.4 40.5 24 30 28 29.4 134 40.5 24 30 28 29.4 134 40.5 24 30 28 29.4 134 40.5 24 30 28 29.4 134 40.5 24 30 28 29.4 134 40.5 34 40 32.8 184 403 34 29 30 32.8 184 403 34 29 30 32.8 184 403 34 29 30 32.8 184 403 34 29 30 32.8 184 403 37.7 42 42 42.5											4	118
18 S 31.7 0.0 83 29.4 31.7 19 30 28 29.4 83 155 23 S 40.5 0.0 108 29.4 40.5 24 30 28 29.4 85 249 28 S 49.3 0.0 143 28.4 49.3 29 30 28 29.4 134 405 33 S 8.1 0.0 184 32.8 58.1 34 34 29 30 28 29.4 184 603 34 S 8.5 1.0 0 184 32.8 58.1 34 34 37.7 222 867 43 S 75.7 0.0 259 43.0 75.7 45 45 38 43.0 259 1113 48 S 84.5 0.0 292 47.5 84.5 50 50 42 47.5 292 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>8</td><td>30</td><td>26</td><td>29.4</td><td>13</td><td>382</td></t<>							8	30	26	29.4	13	382
23 \$ 40.5 0.0 108 29.4 40.5 2.4 30 28 29.4 85 240 28 \$ 49.3 0.0 143 29.4 40.3 29 30 28 29.4 13.8 40.5 33 \$ 58.1 0.0 184 32.8 58.1 34 94 29 32.8 184 803 34 \$ 88.9 0.0 222 37.4 86.9 39 39 33 37.4 222 88.7 35 \$ 75.7 0.0 259 43.0 75.7 45 45 38 43.0 259 1113 48 \$ 84.5 0.0 222 47.5 84.5 50 50 42 47.5 292 1347 58 \$ 84.5 0.0 322 47.5 84.5 50 50 42 47.5 292 1347 58 \$ 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 219.6 63 \$ 110.9 0.0 388 63.4 110.9 65 85 56 83.4 38.8 2459 63 \$ 110.7 0.0 374 89.1 119.7 70 70 61 60.1 374 2544 73 \$ 128.5 0.0 357 77.0 128.5 76 78 88 77.0 357 2748 73 \$ 128.5 0.0 368 83.8 137.3 81 81 74 83.8 30.8 2581 83 \$ 146.1 0.0 247 90.8 146.1 86 86 80 90.8 247 2237 84 \$ 154.9 0.0 171 174 1554.9 91 91 86 97.4 171 1865 93 \$ 163.7 0.0 100 105.3 183.2 170.0 100 100 100 113.2 25 281 103 \$ 190.1 20.1 7 113.2 170.0 100 100 100 113.2 55 66.7 103 \$ 181.3 11.3 25 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 5 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2 22 118 \$ 207.7 37.7 0 113.2 170.0 100 100 100 100 113.2 2							13	30	26	29.4	28	823
28 S 49.3 0.0 143 29.4 40.3 29 30 28 29.4 138 40.5 33 S 58.1 0.0 184 32.8 58.1 34 34 29 32.8 184 80.3 34 S 88.9 0.0 232 37.4 68.9 39 39 33 37.4 232 887 43 S 75.7 0.0 259 43.0 75.7 45 45 38 43.0 259 1113 48 S 84.5 0.0 252 47.5 84.5 50 50 42 47.5 292 1347 58 S 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 128.5 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 128.6 3 S 110.9 0.0 388 83.4 110.9 65 85 56 83.4 388 2459 68 S 110.9 0.0 388 83.4 110.9 65 85 56 83.4 388 2459 68 S 119.7 0.0 374 89.1 119.7 70 70 61 60.1 374 254.7 3 S 128.5 0.0 357 77.0 128.5 76 78 68 77.0 357 2748 83 S 137.3 0.0 308 83.8 137.3 81 81 74 83.8 308 259 83 S 146.1 0.0 247 90.6 146.1 88 88 80 00.6 247 227.8 85 154.9 0.0 171 97.4 154.9 91 91 86 87.4 171 1665 93 S 163.7 0.0 100 100 100 100 103 132 59 667 103 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 59 667 103 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 7 79.1 13 S 198.9 28.9 28.9 28.9 28.9 28.9 28.9 28.9				83	29.4	31.7	19	30	26	29.4	53	1558
33 S 58.1 0.0 194 32.8 59.1 34 34 29 32.8 194 603 34 S 68.9 0.0 232 37.4 68.9 39 39 33 37.4 232 867 43 S 75.7 0.0 259 43.0 75.7 45 45 38 43.0 259 1113 48 S 84.5 0.0 292 47.5 84.5 50 50 42 47.5 292 1337 58 S 102.1 0.0 343 52.1 93.3 55 56 48 52.1 343 1747 58 S 102.1 0.0 381 57.7 102.1 60 60 51 57.7 381 2198 63 S 110.9 0.0 388 63.4 110.9 65 85 56 83.4 388 2459 63 S 110.9 0.0 374 89.1 119.7 70 70 81 89.1 374 2584 63 S 119.7 0.0 374 89.1 119.7 70 70 81 89.1 374 2584 63 S 137.3 0.0 368 83.8 137.3 81 81 74 83.8 368 2581 83 S 146.1 0.0 247 90.6 146.1 86 88 80 90.8 247 2237 83 S 154.9 0.0 171 97.4 154.9 91 91 88 97.4 171 1865 93 S 163.7 0.0 100 105.2 163.7 98 98 97.4 171 1865 93 S 163.7 0.0 100 105.2 163.7 98 98 97.4 171 1865 93 S 181.3 11.3 25 113.2 170.0 100 100 100 113.2 25 231 103 S 198.9 28.9 2 113.2 170.0 100 100 100 113.2 25 221 118 S 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2 22 118 S 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2 22 118 S 207.7 37.7 0 113.2 170.0 100 100 100 113.2 2											85	2499
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				8602			,	. • •			4059	253789

PLANT NO BUILDING DESIGN L WINTER I SIMULATI	NO: OAD:	:	9 7050 306 15 EQ-2M	TONS %DSGN	COMPRI COMPRI CONDEN REFRIGI STATUS	ISER: ERANT:	NO (LE	AD):		CENT WATER R-123 NEW		COMPR CONDE REFRIG STATUS	NSER: ERANT:	r no (la	9 1):		CENT WATER R-123	
PEAK DE			200.8 544903	KWH/YR	CONFIG	URATION:		DATELO	AD:	PARALLE 80	1 2	CONFIG	URATION				PARALLE	
DEMAND			\$30,812 \$13,078	∕∕R ∕∕R	LOAD LI		or Fro	na ie co.	AU.	100	%	LGAD L	SETPOR MIT:	NI:			NA 100	%
TOTAL CO			\$43,889	MR	RATED					153.0 100.3	TONS	RATED					153.0 100.3	TONS KW
UNITOUT	PUT COST:		\$143	/TON"YR	RATED	EFFICIENC	CY;			0.658	KW/TON	RATED	EFFICIEN	CY:			0.656	KW/TON
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
%	TONS	TONS	HRYR	ĸw	TONS	%	%	%	KW	HRYR	KWHYR	TONS	%	%	%	ĸw	HR/YR	KWHYR
15 W		0.0	4380	26.1	45.9	30	30	26	26.1	4380	114318	0.0				0.0	 0	0
3 \$	9.2	0.0	37	26.1	9.2	6	30	26	26.1	7	183	0.0	0	0	0	0.0	0	ō
8 S 13 S	24.5	0.0	50	26.1	24.5	16	30	26	26.1	27	705	0.0	0	0	0	0.0	0	0
13 S	39.8 55.1	0.0	65 83	26.1 30.1	39.8 55.1	26 38	30 36	26 30	26.1 30.1	56 83	1462	0.0	0	0	0	0.0	0	0
23 5	70.4	0.0	106	38.1	70.4	46	48	38	38.1	106	4039	0.0	0	0	0	0.0	0	0
28 5	85.7	0.0	143	47.1	85.7	56	56	47	47.1	143	6735	0.0	0	0	Ď	0.0	0	0
33 S	101.0	0.0	184	57.2	101.0	66	88	57	57.2	184	10525	0.0	ŏ	ŏ	ŏ	0.0	ň	ŏ
38 S	116.3	0.0	232	68.2	118.3	76	76	88	68.2	232	15822	0.0	ŏ	ŏ	ŏ	0.0	ŏ	ŏ
43 S	131.6	0.0	259	72.2	65.8	43	43	38	36.1	259	9350	65.8	43	43	36	38.1	259	9350
48 S	148.9	0.0	292	80.2	73.5	48	48	40	40.1	292	11709	73,4	48	48	40	40.1	292	11709
53 S 58 S	162.2	0.0	343	88.2	81.1	53	53	44	44.1	343	15126	81.1	53	53	44	44.1	343	15126
83 S	177.5 192.8	0.0 0.0	381 388	98.2 108.4	88.8	58 63	58 63	49 54	49.1 54.2	381	18707	88.7	58	58	49	49.1	381	18707
68 5	208.1	0.0	374	118.4	104.1	68	88	59	59.2	388 374	21030 (96.4 104.0	63 68	63 68	54 59	54.2	388	21030
73 5	223.4	0.0	357	128.4	111.7	73	73	64	64.2	357	22919	111.7	73	73	59 64	59.2 64.2	374 357	22141
74 S	238.7	0.0	308	140.4	119.4	78	78	70	70.2	308	21622	119.3	78	78	70	70.2	308	21622
83 S	254.0	0.0	247	152.4	127.0	83	83	76	78.2	247	18821	127.0	83	83	76	76.2	247	18821
88 S	269.3	0.0	171	164.4	134.7	88	88	82	82.2	171	14056	134.6	88	8.8	82	82.2	171	14058
93 \$	284.6	0.0	109	178.6	142.3	93	93	89	89.3	109	9734	142.3	93	93	89	89.3	109	9734
98 S	299.9	0.0	59	192.6	150.0	98	98	98	96.3	59	5882	149.9	98	98	96	96.3	59	5682
103 S	315.2	9.2	25	200.6	153.0	100	100	100	100.3	25	2508	153.0	100	100	100	100.3	25	2508
108 S	330.5	24.5	7	200.6	153.0	100	100	100	100.3	7	702	153.0	100	100	100	100.3	7	702
113 S	345.8	39.8	2	200.6	153.0	100	100	100	100.3	2	201	153.0	100	100	100	100.3	2	201
110 5	381.1	55.1		200.6	153.0	100	100	100	100.3	0	0	153.0	100	100	100	100.3	0	0
			8602	i i						8540	350595						3322	194308

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

LANT NO:			10 7051		MASTER	CHILLER	NO (LEA	ND):		14	!	MASTER	CHILLE	NO (LA	3 1);		15	
DESIGN LO			159	TONS	COMPRE	SSOR.				CENT	;	COMPR	ESSOR:				CENT	
			15	%DSGN	CONDEN					WATER		CONDE					WATER	
VINTER L			EQ-1	76DSGR	REFRIGI					R-123	:	REFRIG					R-11	
MULAIR	ON MODEL:		EQ-1		STATUS					NEW	i	STATUS					EXIST	
EAK DEM			104.1	KW						SERIES/	CTVE		URATION				SERIES/	EDIND
CONSUMP	TION:		282469	KWHYR		URATION:		DATELA	A De	NA NA	%		SETPO				NA NA	*
			\$15.886	MR	LOAD LI		or FRO	na i E LO	ND.	100	v.	LOAD L		***			100	×
EMAND (\$8,779		LOAD L	WII I :				100	~	EUND L					,,,,	
NERGY C				A'R		CAPACITY				158.0	TONS	DATED	CAPACIT	v.			170.0	TONS
TOTAL CO	OST:		\$22,665	A'R			1;			104.1	KW	RATED		١.			121.0	KW
					RATED		A17				KW/TON		EFFICIEN	ev.			0.712	KW/TON
JNIT OUTF	PUT COST:		\$143	/TON"YR	RATED	FFICIEN	CY:			0.659	KW/ION	MAILU	E-FICIEN				0.712	
	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
SGN		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSUM
OAD		J. 120				ACT	ADJ						ACT	ADJ				
OND											i							
6	TONS	TONS	HR/YR	KW	TONS	%	%	%	KW	HR/YR	KWHYR	TONS	%	*	*	KW	HRYR	KWHYR
15 W	23.7	0.0	4380	27.1	23.7	15	30	26	27.1	2190	59349		0	0		0.0	0	,
3 S	4.7	0.0	37	27.1	4.7	3	30	26	27.1	4	108		0	0		0.0	0	
8 S	12.6	0.0	50	27.1	12.6	8	30	26	27.1	13	352		0	0		0.0	0	
13 S	20.5	0.0	65	27.1	20.5	13	30	26	27.1	28	759		0	0		0.0	0	
18 S	28.4	0.0	83	27.1	28.4	18	30	26	27.1	50	1355		0	0		0.0	0	
23 5	36.3	0.0	108	27.1	36.3	23	30	26	27.1	81	2195		0	0		0.0	0	
28 S	44.2	0.0	143	27.1	44.2	28	30	26	27.1	133	3604		0	0		0.0	0	
33 S	52.1	0.0	184	29.1	52.1	33	33	28	29.1	184	5354		0	0		0.0	0	
34 S	60.0	0.0	232	33.3	60.0	38	38	32	33.3	232	7728		0	0		0.0	0	
43 5	67.9	0.0	259	37.5	67.9	43	43	36	37.5	259	9713		0	0		0.0	0	
48 S	75.8	0.0	292	41.6	75,8	48	48	40	41.6	292	12147		0	0		0.0	0	
53 S	83.7	0.0	343	45.8	83.7	53	53	44	45.8	343	15709		0	0		0.0	0	
58 S	91.6	0.0	381	51.0	91.6	58	58	49	51.0	381	19431		0	0		0.0	0	
63 S	99.5	0.0	388	58.2	99.5	63	63	54	56.2	388	21806		0	0		0.0	0	
68 S	107.4	0.0	374	61.4	107.4	68	68	59	61.4	374	22964		0	0		0.0	0	
73 S	115.3	0.0	357	66.6	115.3	73	73	84	66.6	357	23776		0	0		0.0	0	
78 S	123.2	0.0	308	72.9	123.2	78	78	70	72.9	308	22453		0	0		0.0	0	
83 S	131.1	0.0	247	79.1	131.1	83	83	76	79.1	247	19538		ō	0		0.0	0	
48 S	139.0	0.0	171	85.4	139.0	88	88	82	85.4	171	14603		0	0		0.0	0	
93 S	146.9	0.0	109	92.6	146.9	93	93	89	92.6	109	10093		0	0		0.0	0	
98 S	154.8	0.0	59	99.9	154.8	98	98	96	99.9	59	5894		0	0		0.0	0	
103 S	162.7	4.7	25	104.1	158.0	100	100	100	104.1	25	2603		0	0		0.0	0	
108 S	170.6	12.6	7	104.1	158.0	100	100	100	104.1	7	729		0	0		0.0	0	
113 S	178.5	20.5	2	104.1	158.0	100	100	100	104.1	2	208		0	0		0.0	0	
118 S		28.4	ō	104.1	158.0	100	100	100	104.1	ō	0		0	0		0.0	ō	
			8602		1					6237	282469							

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT NO: BUILDING NO:		13 14020		MASTER	CHILLE	NO (LE	AD):		20	
DESIGN LOAD: WINTER LOAD: SIMULATION MO	DEL:	154 0 EQ-1	Tons %Dsgn	COMPRI CONDER REFRIG STATUS	NSER: ERANT:				CENT WATER R-123 NEW	
PEAK DEMAND: CONSUMPTION:		101.0 219473	KW KWHYR	CONFIG MAX LE	URATION AD SETP		RATELO	AD:	SINGLE NA	*
DEMAND COST: ENERGY COST: TOTAL COST:		\$15,413 \$5,267 \$20,680	AYR AYR AYR		CAPACIT	Y:			100 154.0	% TONS
UNIT OUTPUT CO	ost:	\$134	/TON"YR	RATED	POWER: EFFICIEN	CY:			101.0 0.656	KW/TON
% PLAN' PLANT LOAD DSGN LOAD		ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
% TONS	TONS	HR/YR	ĸw	TONS	*	*	*	KW	HR/YR	KWH/YR
	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	4380 37 50 85 83 108 143 184 232 259 292 343 381 388 374 357 308 247 171 109 59 25	0.0 29.3 26.3 26.3 26.3 26.3 26.3 26.3 32.2 36.4 40.4 44.4 45.5 54.5 54.6 70.7 78.8 82.8 82.9 97.0	0.0 d.8 d.8 d.8 d.8 d.8 d.8 d.8 d.8 d.8 d.8	0 3 8 13 18 23 29 33 38 43 48 53 63 63 63 78 84 93 93 93	0 15 15 18 23 28 33 38 43 48 59 58 69 73 78 88 83 93 93	0 26 26 25 26 26 28 35 40 44 49 54 70 76 89 96	0.0 263 263 263 263 263 263 263 323 364 404 444 49.5 59.6 64.6 77.7 76.8 82.8 89.9 97.0 101.0	0 7 7 7 7 56 83 106 143 184 232 259 292 343 381 388 374 357 306 247 171 109 59	0 184 710 1473 2183 2784 37816 5207 7494 9428 11797 15229 21148 22290 23062 21778 18970 14159 9799 5723
108 S 166 113 S 174 118 S 181	.0 12.3 .0 20.0	7 2 0 8602	101.0 101.0 101.0	154.0 154.0 154.0	100	100	100	101.0 101.0 101.0	7 2 0 4160	707 202 0 219473
PLANT NO: BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO	DEL:	14 14023 168 0 EQ-1	TONS %DSGN	COMPRI CONDE REFRIG STATUS	NSER: ERANT:	NO (LE	AD):		21 CENT WATER R-123 NEW	
PEAK DEMAND: CONSUMPTION: DEMAND COST:		110.2 239506 \$16,817	KW KWH/YR /YR	CONFIG	URATION AD SETPT		RATELO	AD:	SINGLE NA 100	% %
ENERGY COST: TOTAL COST: UNIT OUTPUT CO	OST:	\$5,748 \$22,565 \$136	MR MR MONTYR	RATED	CAPACITY POWER: EFFICIEN				166.0 110.2 0.684	TONS KW KW/TON
% PLAN PLANT LOAD DSGN LOAD		ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
* TONS	TONS	HR/YR	KW	TONS	*	%	%	KW	HR/YR	KWH/YR
3 S 5 5 13 13 S 21 18 S 22 18 S 28 S 48 28 S 63 S 5 10 48 S 71 48 S 71 78 S 12	.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4390 50 65 83 108 143 184 232 255 292 343 381 388 374 357 109 50 50 50 7	0.0 28.7 28.7 28.7 28.7 28.7 30.9 35.3 39.7 44.1 44.5 56.0 77.5 83.8 90.4 98.1 105.8 110.2	121.2 129.5	0 3 8 13 18 23 28 33 38 43 43 43 59 59 59 98 100 100	0 15 15 15 123 28 33 48 53 68 53 68 77 88 83 93 98 100	0 28 28 28 28 26 28 32 38 40 44 54 59 89 89 100	0.0 28.7 28.7 28.7 28.7 28.7 28.7 30.9 35.3 44.1 48.5 54.0 59.5 70.5 77.1 83.8 90.4 105.8 1105.8 1105.8	0 7 27 58 83 106 143 184 232 259 292 343 381 388 374 357 308 77 171 109 59 25 7	0 201 775 16077 16

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT NO: BUILDING NO:									22	
BUILDING NO:		15 21002	!	MASTER	CHILLER	NO (LEA	D):		22	
DESIGN LOAD:		21002	TONS	COMPRE					CENT	
WINTER LOAD: SIMULATION MODEL:		0 EQ-1	%DSGN	REFRIGE					WATER R-123	
				STATUS:					NEW	
PEAK DEMAND: CONSUMPTION:		169.4 368062	KWH/YR	CONFIGU	RATION:				SINGLE	
			į	MAX LEA	DSETPT	or PRO-F	RATELOA	D:	NA 100	*
DEMAND COST:		\$25,850	MR I	LOAD LIN	HT:				100	76
ENERGY COST: TOTAL COST:		\$8,833 \$34,684	AR I	RATED C	APACITY	:			240.0	TONS
			i	RATED P					0.706	KW/TON
UNIT OUTPUT COST:		\$145	/TONYYR	RATED E	FFICIENC	:Y:				KH/10N
% PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL ENERGY
PLANT LOAD	LOAD	OCCUR ACTUAL	DEMAND	LOAD	CAP	CAP	RAT POW		ADJUST	CONSUMP
DSGN LOAD	SHED	ACTUAL			ACT	ADJ	7011		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•••••
% TONS	TONS	HRYR	kw i	TONS	%	%	%	ĸw	HR/YR	KWHYR
		4380	0.0	0.0				0.0		0
0 W 0.0 3 S 7.2	0.0	37	44.0	7.2	3	15	26	44.0	7	308
8 S 19.2	0.0	50	44.0	19.2	8	15	26	44.0	27 56	1188 2484
13 S 31.2	0.0	65 83	44.0 44.0	31.2 43.2	13 18	15 18	26 26	44.0 44.0	83	3652
18 S 43.2 23 S 55.2	0.0	106	44.0	55.2	23	23	26	44.0	108	4884
28 S 87.2	0.0	143	44.0	67.2	28	28	26	44.0 47.4	143 184	8292 8722
33 \$ 79.2	0.0	184 232	47.4 54.2	79.2 91.2	33 38	33	28 32	54.2	232	12574
38 S 91.2 43 S 103.2	0.0	259	61.0	103.2	43	43	36	61.0	259	15799
48 S 115.2	0.0	292	67.8	115.2	48	48	40	67.8 74.5	292 343	19798 25554
53 S 127.2 58 S 139.2	0.0	343 381	74.5 83.0	127.2 139.2	53 58	53 58	44	74.5 83.0	343	31623
58 S 139.2 63 S 151.2	0.0	381	91.5	151.2	63	63	54	91.5	388	35502
68 \$ 163.2	0.0	374	99.9	163.2	68	68	59	99.9	374	37363
73 S 175.2	0.0	357 308	108.4 118.6	175.2 187.2	73 78	73 78	70	108.4 118.6	357 308	38699 38529
78 S 187.2 83 S 199.2	0.0	247	128.7	199.2	83	83	76	128.7	247	31789
88 5 211.2	0.0	171	138.9	211.2	88	88	82	138.9	171	23752 16437
93 S 223.2	0.0	109 59	150.8 162.6	223.2 235.2	93 98	93 98	89 98	150.8 162.6	109 59	9593
98 S 235.2 103 S 247.2	0.0 7.2	26	189.4	240.0	100	100	100	169.4	25	4235
108 S 259.2	19.2	7	189.4	240.0	100	100	100	169.4	7 2	1186 339
113 S 271.2 118 S 283.2	31.2 43.2	2	169.4 169.4	240.0	100 100	100	100	169.4	ő	0
118 5 2832	43.2		100.0	240.0						
		8602							4160	368062
PLANT NO:		16		MASTER	CHILLER	NO (LE			23	
BUILDING NO: DESIGN LOAD: WINTER LOAD:		27004 488 0	TONS %DSGN	COMPRE	SSOR:	NO (LE	AD):		23 CENT WATER R-123	
BUILDING NO: DESIGN LOAD:		27004 488 0 EQ-1	%DSGN	COMPRE	SSOR: ISER: ERANT:	NO (LE)	AD):		CENT	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND:		27004 488 0 EQ-1	%DSGN KW	COMPRE CONDEN REFRIGI STATUS	SSOR: ISER: ERANT:		ND):		CENT WATER R-123	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL:		27004 488 0 EQ-1	KW KWHYR	COMPRE CONDEN REFRIGI STATUS CONFIG	SSOR: ISER: ERANT: URATION AD SETP1		AD):	AD:	CENT WATER R-123 NEW SINGLE NA	*
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST:		27004 488 0 EQ-1 273.8 627661 \$41,751	*LDSGN KW KWH/YR	COMPRE CONDEN REFRIGI STATUS	SSOR: ISER: ERANT: URATION AD SETP1			AD:	CENT WATER R-123 NEW SINGLE	* *
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST:		27004 488 0 EQ-1 273.8 627661 \$41,751 \$15,064	*LDSGN KW KWH/YR /YR	COMPRE CONDEN REFRIGI STATUS CONFIG MAX LEA LOAD LI	ESSOR: ISER: ERANT: : URATION ID SETPT MIT:	or PRO-		AD:	CENT WATER R-123 NEW SINGLE NA 100 485.0	% TONS
BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST:		27004 488 0 EQ-1 273.8 827661 \$41,751 \$15,084 \$56,815	*DSGN KW KWHYR //R //R	COMPRICONDES REFRIGI STATUS CONFIG MAX LE/ LOAD LI RATED	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY POWER:	or PRO-		AD:	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6	% TONS KW
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST:		27004 488 0 EQ-1 273.8 627661 \$41,751 \$15,064	*LDSGN KW KWH/YR /YR	COMPRE CONDEN REFRIG STATUS CONFIG MAX LE/ LOAD LI RATED (RATED (ESSOR: ISER: ERANT: URATION ID SETPT MIT:	or PRO-	RATE LO		CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588	% TONS KW KW/TON
BULDING NO: DESIGN LOAD: WHITER LOAD: WHITER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: % PLANT	PLANT	27004 488 0 EQ-1 273.8 627661 \$41,751 \$15,064 \$58,815 \$122	KW KWH/YR /YR /YR /TONTYR PLANT	COMPRE CONDEN REFRIGI STATUS CONFIG MAX LEA LOAD LI RATED I RATED I RATED I CHIL	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY FOWER: EFFICIEN	or PRO-	RATE LO	AD:	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588	TONS KW KW/TON
BULDING NO: DESIGN LOAD: WNTER LOAD: WNTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITT OUTPUT COST: PLANT PLANT LOAD DOSON	PLANT LOAD SHED	27004 488 0 EQ-1 273.8 627661 \$41,751 \$15,064 \$58,815	KW KWHYR //R //R //R /TONYR	COMPRE CONDEN REFRIG STATUS CONFIG MAX LE/ LOAD LI RATED (RATED (ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY CAPACITY RAT CAP	or PRO-	RATE LO		CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588	% TONS KW KW/TON
BULDING NO: DESIGN LOAD: WNTER LOAD: WNTER LOAD: WNTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITT OUTPUT COST: PLANT PLANT LOAD DOSN LOAD	LOAD	27004 488 0 EQ-1 273.8 627661 \$41,751 \$15,064 \$56,815 \$122 ANNUAL OCCUR	KW KWH/YR /YR /YR /TONTYR PLANT	COMPRE CONDEN REFRIGI STATUS CONFIG MAX LEA LOAD LI RATED I RATED I RATED I CHIL	ESSOR: ISER: ERANT: ERANT: URATION ID SETPT MIT: CAPACITY OWER: EFFICIEN RAT	or PRO-	RATE LO.		CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITT OUTPUT COST: TANDER TO TO TO TO TO TO TO TO TO TO TO TO TO	LOAD SHED	27004 488 0 EQ-1 273.8 827661 \$41,751 \$15,084 \$58,815 \$122 ANNUAL OCCUR ACTUAL	%DSGN KW KWHYR //R //R //R //R //TONYR PLANT DEMAND	COMPRISON CONDENTATION CONFIGURATION CONFIGU	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY OWER: EFFICIEN RAT CAP	CY: RAT CAP ADJ	RATE LO. % RAT POW	POWER	CENT WATER R-123 NEW SINGLE NA 100 273.6 0.588 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: YEART LOAD DSON LOAD 0 W 0.0 3 \$ 14.8	TONS 0.0 0.0	27004 488 0 EQ-1 273.8 827681 \$41,751 \$15,064 \$58,815 \$1122 ANNUAL OCCUR ACTUAL HRVR 4380 377	*LOSON KW KWHYYR YR YR YR TON'YR PLANT DEMAND KW 0.0 71.1	COMPRICONDEN CONDEN REFRIGI STATUS CONFIGE MAX LE LOAD LI RATED I RATED I RATED I TONS TONS 10.0	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY POWER: EFFICIEN ACT ACT 0 3	or PRO-	RATE LO. % RAT POW % 25	POWER KW 0.0 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 0.588 ANNUAL OCCUR ADJUST HR/YR 0 7	TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: UNIT OUTPUT COST: VA PLANT PLANT LOAD DSON LOAD V TONS V 0.0 V 0.0 V 1.8 V 3.9 V 3.9 V 3.9	TONS 0.0 0.0 0.0	27004 4888 0 EQ-1 273.8 827681 \$41,751 \$15,084 \$58,815 \$122 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50	KW KWHYR YA YR YA YR YON'YR PLANT DEMAND KW 0.0 71.1 71.1	COMPRICONDEN REFRIGION STATUS CONFIGI MAX LE- LOAD LI RATED I RATED I RATED I TONS 1 TONS 1 14.8 38.9	ESSOR: ISER: ISER: ISERANT: INTERPORT OF THE PROPERTY OF THE P	CY: % RAT CAP ADJ %	RATE LO. % RAT POW % 0 25 26	POWER KW 0.0 71.1 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588 ANNUAL OCCUR ADJUST HR/YR	TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR 1920
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: VINIT OUTPUT COST: VINIT OUTPUT COST: COAD DSON LOAD V. TONS 0 W 0.0 3 S 14.8 8 S 34.9 13 \$ 68.2	TONS 0.0 0.0 0.0 0.0	27004 488 0 EQ-1 273.8 827681 \$41,751 \$15,064 \$58,815 \$1122 ANNUAL OCCUR ACTUAL HRVR 4380 377	KW KWHYR //R //R //R //R //R //R //R	COMPRICONDEN CONDEN REFRIGI STATUS CONFIGE MAX LE LOAD LI RATED I RATED I RATED I TONS TONS 10.0	ESSOR: ISER: ERANT: URATION ID SETPT MIT: CAPACITY POWER: EFFICIEN ACT ACT 0 3	or PRO-	RATE LO. % RAT POW % 25	POWER KW 0.0 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 0.588 ANNUAL OCCUR ADJUST HR/YR	TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR 1920 4387 5901
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: PLANT LOAD DSON LOAD V 0.0 V	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	27004 488 0 EQ-1 273.8 827681 \$41,751 \$15,084 \$58,815 \$1122 ANNUAL HR/YR 4380 37 50 65 83 106	KW KWHYR //R //R //R //R //R //R //R //R //R /	COMPRISON CONTROL CONTROL CONFIGURATION CONF	ESSOR: ISER: ERANT: URATION ND SETPIMIT: CAPACITY OWER: EFFICIEN ACT 0 3 8 14 19 24	% CY: % RAT CAP ADJ % 15 15 15 19 24	% RATE LO. % RAT POW % 0 28 28 26 28 26 28 26 28	POWER 6.0 71.1 71.1 71.1 71.1 71.1	CENT WATER R-123 NEW SINGLE NA 100 273.6 0.588 ANNUAL OCCUR ADJUST HR/YR 0 7 277 81 83 106	TONS KW KW/TON ANNUAL BNERGY CONSUMP KWH/YR 4988 1920 4337 5901 7537
BULDING NO. DESIGN LOAD: WITER LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL- PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITT OUTPUT COST: VA PLANT PLANT LOAD DSON LOAD	TONS	27004 4888 80 EQ-1 273.8 \$27681 \$41,751 \$15,084 \$56,815 \$122 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 85 83 106	**************************************	COMPRICATIONS CONFIGURATION CONFIGURATION RATED I RATED I RATED I CHIL LOAD I CHIL LOAD I CHIL LOAD I 14.8 33.9 87.5 111.8 136.1	SSOR: ISER: ISER: ISER: INTERPORT OF THE PROPERTY OF THE PROPE	% PRO-	% RATE LO. % RAT POW % 25 28 26 26 26 26 26 26	0.0 71.1 71.1 71.1 71.1 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.8 0.588 ANNUAL OCCUR ADJUST HR/YR 109 109 119 119 119 119 119 119 119 119	TONS KW KWITON ANNUAL ENERGY CONSUMP KWHYR 1020 4397 5901 7537 10167
BULDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: PLANT LOAD SON V PLANT LOAD SON V 0.0 3 S 14.8 8 S 38.9 13 S 48.2 18 S 37.5 28 S 138.1 28 S 138.1 28 S 138.1 38 S 138.1 38 S 138.1 38 S 138.1 38 S 138.1	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	27004 488 0 EQ-1 273.8 827681 \$41,751 \$15,084 \$58,815 \$1122 ANNUAL HR/YR 4380 37 50 65 83 106	KW KWHYR //R //R //R //R //R //R //R //R //R /	COMPRICONDEN CONDEN CONFIGURATION CONFIGURAT	SSOR: SER: ERANT: URATION ID SETPT WIT: CAPACITY POWER: EFFICIEN RAT CAP ACT %	"CY: "% RAT CAP ADJ "% 15 15 19 24 40 34 40	% RATE LO. % RAT POW % 0 28 26 26 26 26 26 26 29 34	POWER 6.0 71.1 71.1 71.1 71.1 71.1 79.3 93.0	CENT WATER R-123 R-123 NEW SINGLE NA 100 485.0 273.6 0.588 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 81 108 143 108 144 202	TONS KW KWITON ANNUAL ENERGY CONSUMP KWHYR 0 498 1920 4393 5501 75333 10167 14591
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BULDING NO: DESIGN LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL- PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: V. PLANT LOAD O W O.0 O W O.0 O W O.0 S S 14.8 S 34.9 13 S 85.2 18 S 34.9 13 S 186.7 23 S 111.8 33 S 186.7 43 S 200.0 44 S 203.3 53 S 257.6 54 S 23.3 55 S 23.9 65 S 28.1 65 S 30.92	TONS	27004 488 88 88 80 0 EQ-1 1 273.8 627661 \$41,751 \$15,084 \$55,815 \$122 ANNUAL OCCUR ACTUAL HR/YR 4380 37 37 37 50 65 65 83 104 1184 222 256 292 343 381 388 374	*LOSQN KW KWHYR //R //R //R //R //R //R //R	COMPRICONDES CONDES CONFIGURATED CONFIGURATED RATED RATED RATED TONS TONS TONS 114.6 38.9 163.2 187.5 118.1 160.4 184.7 209.0 233.0 257.6 281.9 306.2 330.5 231.0 330.5	SSOR: SSER: SERNIT. SISER: SERNIT. SISER: SERNIT. SISER: SERNIT. SISERIT. SERNIT. SERN	% CCY: % RAT CAP ACJ 15 15 15 15 15 24 40 45 50 56 61 66 71	% 0 28 28 28 29 34 38 42 48 85 25 57 82	0.0 71.1 71.1 71.1 71.1 71.1 71.1 71.1 104.0 104.0 114.9 125.9 156.0 150.0	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.8 0.588 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 83 106 143 184 222 256 292 343 381	% TONS KW KW/TON ANNUAL BERGY CONSUMP KWH-VR 1920 499 1920 43937 5001 75337 10167 14557 43184 54212 60522
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BULDING NO: DESIGN LOAD: WITER LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: UNIT OUTPUT COST: WITT OUTPUT COST: TONS	TONS	27004 4888 9 0 EQ-1 273.8 \$27881 \$41,751 \$15,084 \$58,815 \$122 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 65 83 108 143,2 22,2 259 292,3 341 388 374 297,3 308 297,3 2	*XOSQN KW KWHYR YR YR YR YR TON'YR PLANT DEMAND 6.0 71.1	COMPRICONDEN CONDEN CONDEN CONFIGURATION CON	ISSOR: ISSER: ERANT: URATION OD SETPIN MIT: CAPACITY CAPA	CY:	% RATELO. % RAT POW % 26 26 26 29 34 48 52 57 62 87 65 81 75 81	POWER KW 0.0 0.0 71.1 71.1 71.1 71.1 79.3 93.0 104.0 114.9 1125.9 1428.0 168.8 188.0 205.2	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.6 0.588 ANNUAL OCCUR ADJUST HRYR 0 7 7 81 83 3108 143 144 232 259 243 381 388 374 357 308 247	% TONS KW KWTON ANNUAL ENERGY CONSUMP (1920 4397 59010 7537 10167 14591 21578 26038 335555 34314 54218 66028 64030 54205 54218 54205 54205 54205 54205 54205
BULDING NO: DESIGN LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL: PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITT OUTPUT COST: TOTAL COST: UNIT OUTPUT COST: TOTAL COST: UNIT OUTPUT COST: 10 W 0.0 3 S 14.8 8 S 349.9 13 S 349.1 13 S 349.1 14 S 27.5 25 S 111.8 28 S 129.1 29 S 129.1 20 S 129.1 20 S 129.1 21 S 200.0 21 S 200.0 21 S 200.0 21 S 200.0 21 S 200.0 22 S 200.0 23 S 144.7 24 S 200.0 25 S 22.1 26 S 300.2 27 S 300.2 28 S 300.5 27 S 354.8 28 S 30.5 27 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 28 S 379.1 29 S 427.7	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	27004 488 88 80 6 EQ-1 1 273.8 627661 \$41,751 \$15,064 \$55,815 \$122 ANNUAL OCCUR ACTUAL HR/YR 4380 37 37 37 37 37 39 39 31 31 34 34 35 36 37 37 37 38 38 37 47 38 38 37 47 38 38 38 38 38 38 38 38 38 38	*LOSQN KW KWHYA //R //R //R //R //TON'YR PLANT DEMAND KW 0.0 71.1 7	COMPRICONDES CONDES CONFIGURATED CONFIGURATE	SSOR: SSER: SERNIT SIRERI SIGNIT SIRERI SIRE	or PRO-	% 0 28 28 29 34 38 22 43 35 25 78 26 88 75 82	0.0 71.1 71.1 71.1 71.1 71.1 71.1 71.1 7	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.8 0.588 ANNUAL OCCUR ADJUST HRVYR 0 7 7 61 83 106 143 184 222 259 243 381 388 374 387 308 247 171 109	% TONS KW KW/TON ANNUAL ENERGY CONSUMP 0 499 1920 4337 59010 7537 10167 24592 21577 24592 335555 43194 54214 80522 84430 85202
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BULDING NO: DESIGN LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: WITTOUTPUT COST: TOTAL OAD TONS TONS	27004 4888 80 EQ-1 273.8 \$27681 \$41,751 \$15,084 \$56,815 \$122 ANNUAL OCCUR ACTUAL HR/YR 4380 377 50 65 83 108 143,43 184 232 22 259 202 202 202 202 203 317,111 109 59 59 59 59 59 59 59 59 59 59 59 59 59	*LOSQN KW KWHYR /YR /YR /YR /YR /TON'YR PLANT DEMAND KW 0.0 71.1 71.1 71.1 71.1 71.1 71.1 71.1	COMPRICONDEN CONDEN CONDEN CONFIGURATION CON	ISSOR: ISSER: ERANT: URATION OD SETPING INTO OUT OF INTO OUT OF INTO OUT OF INTO OUT OUT OUT OUT OUT OUT OUT OUT OUT O	CY:	% RATE LO. % RAT POW % 28 28 26 28 26 28 26 28 26 38 38 38 52 68 75 68 81 88 95 100 100 100 100 100 100 100 100 100 10	POWER KW 0.0 71.1 71.1 71.1 71.1 71.1 71.1 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.8 0.588 ANNUAL OCCUR ADJUST HRVYR 0 7 7 61 83 106 61 83 108 143 184 222 259 259 259 343 381 388 374 387 308 247 171 100 59 25	% TONS KW KW/TON ANNUAL ENERGY CONSUMP 0 499 1920 4337 5501 7537 10167 26036 335555 43184 52216 6402 83200 5433 64102 83201 84107 2822 841177 2822 84117 2822 84117	
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BULDING NO: DESIGN LOAD: BUSION LOAD: WITER LOAD: WITER LOAD: SIMULATION MODEL- PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COST: V. PLANT LOAD 0 W 0.0 3 S 14.6 8 S 34.9 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 63.2 13 S 77.5 23 S 134.7 24 S 200.0 25 S 25.7 26 S 300.2 27 S 354.8 28 S 300.5 27 S 354.8 28 S 379.1 29 S 452.0 29 S 452.0 29 S 470.3 20 S 452.0 20	TONS	27004 4888 9 EQ-1 273.6 827681 \$41,751 \$15,064 \$58,815 \$122 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 65 83 31 164 212 225 90 2292 2343 331 3388 3374 237 300 247 117 110 109 59 25 7	*LOSQN KW KWHYA //R //R //R //TON'YR PLANT DEMAND KW 0.0 71.1	COMPRICATIONS CONFIGURATION OF THE PROPERTY O	ESSOR: ISER: ERANT: URATION OD SETPT WITH TO SET TO	7: or PRO- 7: CY:	% 0 28 28 28 29 34 38 25 57 82 68 75 81 100 100 100 100 100 100 100 100 100	POWER 0.0 71.1 71.1 71.1 71.1 71.1 71.1 71.1	CENT WATER R-123 NEW SINGLE NA 100 485.0 273.8 0.588 ANNUAL OCCUR ADJUST HR/YR 0 7 27 61 83 108 1108 144 232 259 292 343 381 384 374 357 370 308 2477 171 109 59 25 7	% TONS KW KW/TON ANNUAL ENERGY CONSUMP 1920 499 1920 43937 5901 75337 10167 14591 21576 26036 33551 4314 54216 6402 6402 6432 64177 28326 16144 6844

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

COLUMN C	PLANT NO:		17	<u>-</u>	MASTER	CHILLE	NO (LE	AD):		24		MASTER	CHILLER	NO (LA	3 1):		25	1
COMMONDMENT DESCRIPTION COMMONDMENT	WINTER LOAD: SIMULATION MODEL	: 	0 EQ-2M	%DSGN	CONDEN	SER: ERANT:				WATER R-123		REFRIG	ISER: ERANT:				WATER R-123	
TOTAL CORPT SALES AFF	CONSUMPTION: DEMAND COST:		352402 \$24,998	KWHYR I	MAX LEA	O SETP		RATELO	AD:	80	*	MIN LAG	SETPOR				NA	%
PLANT CAD CA	TOTAL COST:		\$33,454	ΛÆ į	RATED	OWER:				81.9	KW	RATED	OWER:				81.9	KW
PAMP LOAD LOAD COLUM DIAMP LOAD RAT RAT COLUMN DIAMP	1 % PLANT	PLANT		PLANT I	CHE				POWER		ANNUAL				- -	POWER		
No. Company PLANT LOAD DSGN	LOAD	OCCUR			RAT	RAT CAP	RAT		OCCUR	ENERGY		CAP	RAT	RAT		OCCUR	ENERGY	
3 8 7,10 0.0 0.0 77	% TONS	TONS	HR/YR	kw i	TONS	%	%	*	KW	HRYR	KWHYR	TONS	%	*	%	KW	HR/YR	KWHYR
PLANT HOC 18	3 S 7.1 8 S 19.0 13 S 30.9 18 S 42.8 22 S 54.7 28 S 68.6 33 S 78.5 38 S 90.4 43 S 102.3 44 S 114.2 53 S 12.3 54 S 138.0 65 S 151.8 73 S 173.7 78 S 173.7 78 S 173.7 78 S 185.6 83 S 197.5 83 S 202.1 84 S 221.3 85 S 202.1 85 S 202.1 85 S 202.1 86 S 203.2 87 S 203.2 103 S 245.1 108 S 257.0 113 S 288.0	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	97 50 85 83 108 149 184 232 259 202 345 381 388 374 357 171 109 59 25 7	213 213 213 213 213 2148 215 215 215 215 215 215 215 215 215 215	7.1 19.0 30.9 42.8 54.7 66.8 78.5 90.4 51.2 57.1 69.0 75.0 80.9 86.9 92.8 98.8 104.7 110.7 110.7	6 16 26 36 48 56 56 58 53 53 58 53 58 59 99 100 100 100	15 16 26 36 46 56 66 76 43 53 58 63 63 63 88 93 98 100 100	26 28 30 33 47 57 63 40 44 54 54 70 82 89 100 100	21.3 21.3 24.8 31.8 38.5 46.7 29.5 32.8 36.0 40.1 44.2 48.3 52.2 72.9 72.9 81.9 81.9	15 50 65 83 108 143 184 232 259 292 243 381 388 374 357 171 109 59 25 7	320 1085 1385 2042 3207 5506 8593 12922 7641 9578 12348 15273 17150 18064 18707 17946 4837 2048 573 1644	0.0 0.0	0 0 0 0 0 0 0 448 53 583 583 688 73 73 83 83 93 98 100 100	0 0 0 0 0 0 0 0 0 4 4 8 5 3 5 8 8 3 8 8 8 9 8 100 100 100 100 100 100 100 100 100 1	0 0 0 0 0 0 0 0 36 40 44 49 54 70 82 98 100 100	0.0 0.0 0.0 0.0 0.0 0.0 0.0 29.5 32.8 36.0 40.1 44.2 48.3 52.4 57.3 62.2 72.9 81.9 81.9	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
BUILDING NO. 29005 DESIGN LOAD: 838 TONS COMPRESSOR: COMPR				,								' 						
BELIGH LOAD:																		
PEAN DEJAND: 105883	PLANT NO:		18		MASTER	CHILLER	NO (LE)	AD1:		27		MASTER	CHILLER	NO (LAC	3 1):		26	<u> </u>
No. No.	BUILDING NO: DESIGN LOAD: WINTER LOAD:	<u> </u>	29005 836 0		COMPRE CONDEN	ESSOR: ISER: ERANT:	NO (LE	AD):	***************************************	CENT WATER R-123		COMPRE CONDEN	SSOR: ISER: ERANT:	NO (LAC	3 1);		CENT WATER R-123	
Year Plant Plant Plant Plant Cold Demand Cold Col	BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL PEAK DEMAND: CONSUMPTION:	· · · · · · ·	29005 836 0 EQ-2S 495.8 1058637	KW KWHYR	COMPRE CONDEN REFRIGI STATUS: CONFIGI MAX LEA	ESSOR: ISER: ERANT: : URATION LD SETPT	:		AD:	CENT WATER R-123 NEW SERIES/S	%	COMPRI CONDEN REFRIGI STATUS CONFIGI	ESSOR: ISER: ERANT: URATION SETPOR	:	3 1);		CENT WATER R-123 NEW SERIES/S	%
DSAN LOAD LOAD LOAD LOAD ACTUAL LOAD RAT RAT RAT RAT CAP BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL PEAK DEJAIND: CONSUMPTION: DEMAND COST: BNERGY COST: TOTAL COST:		29005 836 0 EQ-2S 495.8 1058637 \$75,629 \$25,407 \$101,036	KW KWHYR MYR COMPRE CONDEN REFRIGI STATUS: CONFIGI MAX LEA LOAD LII RATED C RATED F	ESSOR: ISER: ERANT: : : : : : : : : : : : : : : : : : :	: f or PRO- f:		AD:	CENT WATER R-123 NEW SERIES/S 30 100 426.6 247.8	% TONS	COMPRI CONDEN REFRIGI STATUS CONFIGI MIN LAG LOAD LII RATED (ESSOR: ISER: ERANT: URATION SETPOM MIT: CAPACITO POWER:	: NT: f:	3 1):		CENT WATER R-123 NEW SERIES/S 40 100 428.6 247.8	% % TONS KW		
0 W 0.0 0.0 4380 0.0 0.0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0	BULDING NO: DESIGN LOAD: UNITER LOAD: SIMULATION MODEL PEAK DEMAND: CONSUMPTION: DEMAND COST: BIERGY COST: TOTAL COST: UNIT OUTPUT COST.	:	29005 838 0 EQ-2S 495.8 1058637 \$75,620 \$25,407 \$101,036 \$118	KW KWHYR AR	COMPRECION REFRIGION STATUS: CONFIGURA MAX LEAL LOAD LB RATED CRATED FRATED FRA	ESSOR: ISER: ERANT: : : : : : : : : : : : : : : : : : :	: f or PRO- f: CY:	RATE LO		CENT WATER R-123 NEW SERIES/S 30 100 426.6 247.8 0.581	% % TONS KW KW/TON	COMPRIS CONDEN REFRIGI STATUS CONFIGI MIN LAG LOAD LII RATED I RATED I	ESSOR: ISER: ERANT: URATION SETPOIN MIT: CAPACITY OWER: EFFICIEN	: NT: /: CY:		POWER	CENT WATER R-123 NEW SERIES/S 40 100 428.5 247.8 0.581	% % Tons KW KW/Ton
3 5 25.1 0.0 37 64.4 25.1 6 15 26 64.4 15 966 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL PEAK DEJAND: CONSUMPTION: DEJAND COST: BNERGY COST: TOTAL COST: UNIT OUTPUT COST: PANT LOAD DSON LOAD	PLANT LOAD SHED	29005 836 0 EQ-25 495.8 1058637 \$75,629 \$25,407 \$101,036 \$118 ANNUAL OCCUR ACTUAL	KW KWHYR KWAR KWAN KWAN KWAN KWAN KWAN KWAN KWAN KWAN	COMPRECONDEN REFRIGI STATUS: CONFIGI MAX LEA LOAD LE RATED C RATED C RATED C CHL LOAD	ESSOR: ISER: ISER: URATION ID SETPT MIT: CAPACITY POWER: EFFICIEN RAT CAP ACT	CY: RAT CAP ADJ	RATE LO. 5% RAT POW	POWER	CENT WATER R-123 NEW SERIES/S 80 100 426.8 247.8 0.591 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL BNERGY CONSUMP	COMPRI CONDEN REFRIGI STATUS STATUS CONFIG MIN LAG LOAD LE RATED I RATED I RATED I	ESSOR: ISER: ERANT: URATION SETPON MIT: CAPACITY WRAT CAP ACT	CY:	% RAT POW		CENT WATER R-123 NEW SERIES/S 40 100 428.8 247.8 0.581 ANNUAL OCCUR ADJUST	% TONS KW KW/TON ANNUAL BNERGY CONSUMP
	BULDING NO; DESIGN LOAD; UNITER LOAD; SIMULATION MODEL PEAK DEMAND; CONSUMPTION; DEMAND COST; ENERGY COST; TOTAL COST; UNIT OUTPUT COST. PAINT PAINT LOAD DSGN LOAD TONS	PLANT LOAD SHED TONS	29005 836 0 EG-25 495.8 1058837 \$75,629 \$25,407 \$101,036 \$118 ANNUAL OCCUR ACTUAL	KW KWHYR KWHYR KWHYR KW KWHYR KWHYR KW KWHYR KWHYR KWHYR KWHYR KWHYR KW	COMPRISON CONDENSITY OF THE PROPERTY OF THE PR	ESSOR: ISER:	CY: ADJ	RATELO.	POWER	CENT WATER R-123 NEW SERIES/S 30 100 426.8 247.3 0.581 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP	COMPRISON CONTROL CONT	ESSOR: ISER: ISER: ISERANT: IS	CY:	%	ĸw	CENT WATER R-123 NEW SERIES/S 40 100 426.6 247.8 0.581 ANNUAL OCCUR ADJUST	% TONS KW KW/TON ANNUAL ENERGY CONSUMP KWH/YR
	BULDING NO. DESIGN LOAD: DESIGN LOAD: DESIGN LOAD: WINTER LOAD: SIMULATION MODEL PEAK DEMAND: CONSUMPTION: DEWAND COST: DERGY COST: TOTAL COST: UNIT OUTPUT COST. WINT OUTPUT COST. UNIT OUTPUT COST. TONS	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	29005 836 0 EQ-25 495.8 1058637 \$75,629 \$25,407 \$101,036 \$118 ANNUAL OCCUR ACTUAL HR/YR 4380 37 60 65 83 100 143 184 222 259 292 344) 381 388 374 357 306 247 171 109 59 25 7	*LDSGN KW KWH-VYR /YR /YR /YR /YR /YR /YR /YR /TON'YR PLANT DEMAND 64.4 84.4 74.3 114.0 138.8 191.1 176.0 195.8 220.8 245.4 240.2 245.0 309.8 358.8 403.9 433.7 485.9 495.8 495.8	COMPRECONDEN CONDEN CONDEN CONDEN CONFIGURA CO	SSOR: SSER:	7: CY: % PRO- 7: CY: % PAT T CAP A RDJ 7: 16 25 56 85 85 85 85 85 85 85 85 85 85 85 85 85	% RATE LO. % RAT POW % 28 28 26 30 39 46 56 55 54 4 45 4 44 44 44 45 10 100 100 100 100 100 100 100 100 100	POWER KW 0.00 0.04.4 64.4 64.4 64.4 74.3 94.2 114.0 138.8 161.1 111.5 138.3 158.6 109.0 133.8 158.6 109.0 133.8 158.6 1247.8 247.8	CENT WATER R-123 R	% TONS KW KW/TON ANNUAL BIEFRRY CONSUMP 0 986 3220 4136 16167 9985 225539 37375 23750 32558 46751 61379 2022 33572 23750 2158620 32588 6196 61751 24888 6196 17735 498	COMPRISON TO NO. 170.6 1	SSOR: ISER: SERANT: UPATION SETPOR MISER: CAPACITY CAPACI	**CY: **ADJ **	% RAT POW % 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	KW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	CENT WATER R-123 NEW SERIES/S 40 100 428.8 247.8 0.581 ANNUAL OCCUR ADJUST HR/YR 0 0 0 0 0 0 0 0 0 0 0 0 0 259 292 343 381 381 381 381 1100 557 300 597 27 7	% TONS KW KW/TON

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

LANT NO:	·		21 36000		MASTER	CHILLER	NO (LEA	(D):		31		MASTER		NO (LAC	1):		30	
ESIGN LOA			1155	TONS	COMPRE	SSOR:				CENT	i	COMPRE					CENT	
INTER LOA			20	%DSGN	CONDEN					WATER	i	CONDEN	ISER:				WATER	
MULATION			EQ-3		REFRIO					R-123	i	REFRIGI	ERANT:				R-123	
mount not					STATUS					NEW	i	STATUS	:				NEW	
EAK DEMAN			741.6	KW j							.!	CONFIG	IDATION.				PARALLE	,
ONSUMPTK	ONE		1919353	KWHYR		JRATION:		DATELO		PARALLE 80	· *		SETPON				NA	*
			\$113,168	ΛΒ	MAX LEA		or PhO-	HATELO	ND:	100	- € i	LOAD L		• • • •			100	%
EMAND COS NERGY COS			\$46,064	A/B	LOAD LE	WW 1 .					~	•						
TAL COST			\$159,233	ΛΥΒ	RATED (APACITY	,.			425.7	TONS I	RATED (CAPACITY	/ :			425.7	TONS
JIAL COST	1.		#109,200	/···	RATED		•			247.2	KW 1	RATED	OWER:				247.2	KW
NIT OUTPU	T COST:		\$125	/TONTYR	RATED E		CY:			0.581	KW/TON	RATED I	FFICIEN	CY:			0.581	KW/TON
			ANNUAL	PLANT	CHIL	- %	*	- * -	POWER	ANNUAL	ANNUAL I	CHIL	*	%	~ ~	POWER	ANNUAL	ANNUAL
	LANT OAD	PLANT LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
SON L	OAD	SHED	ACTUAL	CLIMATO	LUAD	CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSU
DAD		GHEU	AGTORE			ACT	ADJ				j		ACT	ADJ				
	ONS	TONS	HRAYR	ĸw	TONS	%	%	%	ĸw	HRYR	KWHYR	TONS	%	%	%	ĸw	HR/YR	KWHYR
											407074	0.0				0.0		-
20 W	231.0	0.0	4380	111.2	231.0	54	54	45	111.2	4380 20	487056 1286	0.0	ŭ	٥	ŏ	0.0	ŏ	
3 S	34.7	0.0	37	64.3	34.7	8 22	15 22	26 26	64.3	50	3215	0.0	ň	ŏ	ŏ	0.0	ŏ	
8 S	92.4	0.0	50 85	84.3 74.2	92.4 150.2	35	35	30	74.2	65	4823 1	0.0	ŏ	ŏ	ŏ	0.0	ŏ	
13 5	150.2	0.0	83	101.4	207.9	49	49	41	101.4	83	8416	0.0	ŏ	Ď	ŏ	0.0	ō	
18 S 23 S	207.9 265.7	0.0	108	131.0	265.7	62	62	53	131.0	106	13886	0.0	ō	ō	Ö	0.0	0	
28 5	323.4	0.0	143	169.1	323.4	76	78	68	168.1	143	24038	0.0	0	0	0	0.0	0	
33 S	381.2	0.0	184	187.8	190.6	45	45	38	93.9	184	17278	190.6	45	45	38	93.9	184	172
38 S	438.9	0.0	232	212.6	219.5	52	52	43	106.3	232	24662	219.5	52	52	43	106.3	232	246
43 5	498.7	0.0	259	242.2	248.4	58	58	49	121.1	259	31385	248.4	58	58	49	121.1	259	313
48 S	554.4	0.0	292	276.8	277.2	65	65	56	138.4	292	40413 [277.2	65	65	58	138.4	292	404
53 5	612.2	0.0	343	311.4	306.1	72	72	63	155.7	343	53405	306.1	72	72	63	155.7	343 381	534 668
54 S	689.9	0.0	381	351.0	335.0	79	79	71	175.5	381	66866	335.0	79	79 57	71 48	175.5 118.7	381	460
63 S	727.7	0.0	388	356.1	242.6	57	57	48	118.7	388 374	46056 48059	242.6 261.8	57 61	61	52	128.5	374	480
64 S	785.4	0.0	374	385.5	261.8	61	61	52 57	128.5 140.9	374	48059 j 50301 l	281.1	66	66	52 57	140.9	357	503
73 S	843.2	0.0	357	422.7 459.9	281.1	68 71	66 71	62	153.3	308	47216	300.3	71	71	62	153.3	308	472
78 5	900.9 958.7	0.0	308 247	489.6	319.6	75	75	66	163.2	247	40310	319.6	75	75	66	163.2	247	400
83 S	1016.4	0.0	171	534.0	338.8	80	80	72	178.0	171	30438	338.8	80	80	72	178.0	171	304
	1074.2	0.0	109	570.9	358.1	84	84	77	190.3	109	20743	358.1	84	84	77	190.3	109	207
	1131.9	0.0	59	615.8	377.3	89	89	83	205.2	59	12107	377.3	89	89	83	205.2	59	121
	1189.7	0.0	25	660.0	398.6	93	93	89	220.0	25	5500	396,6	93	93	89	220.0	25	55
	1247.4	0.0	7	711.9	415.8	98	98	96	237.3	7	1661	415.8	98	98	98	237.3	7	16
	1305.2	28.1	2	741.6	425.7	100	100	100	247.2	2	494	425.7	100	100	100	247.2	2	4
	1382.9	85.8	0	741.6	425.7	100	100	100	247.2	0	0	425.7	100	100	100	247.2	0	
			8602							8585	1079594						3738	5368

8	LANT WLDI DESIGN VINTE	NG!	NO: DAD:		36006 259 0	TONS 1	COMPRE	ISER:	NO (LEA	(D):		33 CENT WATER	
5	JUME	TIC	N MODEL:		EQ-1	i	REFRIGI STATUS:					R-123 NEW	
	PEAK D				187.5 381538	KWHYR	CONFIG	URATION				SINGLE NA	*
1	EMAN	100	COST:		\$28,613	Λ⁄R	LOAD LI		or PHU-	HATELO	AU:	100	%
E	NERG	Y C	COST:		\$9,157	AVB							
1	OTAL	co	ST:		\$37,769	WA I		APACIT	r:			275.0 187.5	TONS KW
١,	INIT O	UTF	PUT COST:		\$137	/TONTYR	RATED F	owen: Efficien	CY:			0.682	KW/TON
	6	_	PLANT	PLANT	ANNUAL	PLANT	CHIL		%	- *	POWER	ANNUAL	ANNUAL
	THAP		LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
	SON			SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP
	OAD					į		ACT	ADJ				
•	4		TONS	TONS	HRYR	ĸw	TONS	%	%	%	KW	HRYR	KWHYR
	0	w	0.0	0.0	4380	0.0	0.0		0	0	0.0	0	0
	3	s	7.8	0.0	37	48.8	7.8	3	15	26	48.8	.7	342
	8	s	20.7	0.0	50	48.8	20.7	8	15	26	48.8	27	1318
	13	S	33.7	0.0	65	48.8	33.7	12	15	26	48.8	52	2538
	18	5	46.6	0.0	83	48.8	46.6	17	17	26	48.8	83 108	4050 5173
	23	S	59.6	0.0	108	48.8	59.6	22	22	26	48.8	143	6978
	28	S	72.5	0.0	143	48.8	72.5	26 31	26 31	26 27	48.8 50.6	184	9310
	33	s	85.5	0.0	184	50.6	85.5	36	38	30	58.3	232	13082
	38	S	98.4	0.0	232 259	56.3	98.4 111.4	41	41	34	63.8	259	16524
		s	111.4	0.0	292	53.8 71.3		45	45	38	71.3	292	20820
	48 53	S	124.3 137.3	0.0	343	78.8		50	50	42	78.8	343	27028
		S	150.2	0.0	381	88.3		55	55	46	86.3	381	32880
	63		183.2	0.0	388	93.8		59	59	50	93.8	388	36394
	68	S	178.1	0.0	374	103.1		84	64	55	103.1	374	38559
		s	189.1	0.0	357	112.5		69	69	80	112.5	357	40163
		s	202.0	0.0	308	120.0	202.0	73	73	64	120.0	308	36960
	83	s	215.0	0.0	247	131.3	215.0	78	78	70	131.3	247	32431
	8.8	s	227.9	0.0	171	142.5	227.9	83	83	78	142.5	171	24368
	93	s	240.9	0.0	109	153.8		88	88	82	153.8	109	16764
	98	S	253.8	0.0	59	165.0		92	92	88	165.0	59	9735
			266.8	0.0	25	178.1		97	97	95	178.1	25	4453
	108		279.7	4.7	7	187.5		100	100	100	187.5	7	1313
	113		292.7	17.7	2	187.5		100	100	100	187.5	2	375
	118	S	305.8	30.6	0	187.5	275.0	100	100	100	187.5	0	0
1					8602							4156	381538

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT NO: BUILDING NO: DESIGN LOAD: WINTER LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT CO		24 36014 98 7 10 EQ-1 81.8 233938 \$12,483 \$5,615 \$18,097	TONS %DSGN KW KW-LYR //R //R //TON'YR	COMPRI CONDET REFRIG STATUS CONFIG MAX LE LOAD LI RATED C	ISER: ERANT: : URATION AD SETP1 MIT: CAPACITY	: or PRO- Y:	AD):	AD:	38 RECIP WATER R-22 NEW SINGLE NA 100 98.2 81.8 0.850	% % TONS KW KW/TON							
% PLAN PLANT LOAD DSGN LOAD		ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL	% RAT GAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP							
% TONS	TONS	HRYR	ĸw	TONS	*	*	%	KW	HRYR	KWH/YR	_						
3 \$ 2	3 0.0 .1 0.0 .9 0.0 .7 0.0 .5 0.0 .3 0.0 .1 0.0 .9 0.0 .7 0.0 .9 0.0 .7 0.0 .9 0.0 .7 0.0 .9 0.0 .1 0.0 .9 0.0 .1 0.0 .9 0.0 .1 0.0 .9 0.0 .0 0.0	4380 377 50 85 83 108 143 184 232 259 243 381 388 374 357 308 247 171 109 59 25 7 2	18.8 18.8 18.8 18.8 18.8 18.8 21.3 22.5 29.4 34.4 37.8 40.9 45.0 45.0 45.0 45.0 45.0 45.0 45.0 45.0	9.6 2.9 7.7 12.5 17.3 22.1 28.9 31.7 38.5 41.3 48.1 50.9 55.7 80.5 85.3 70.1 74.9 79.7 84.5 86.3 94.1 96.2 96.2 96.2	10 3 8 13 18 23 28 33 38 48 53 58 63 68 93 100 100 100	15 15 15 15 15 18 23 28 33 34 43 48 53 58 69 73 78 83 89 100 100 100	23 23 23 23 23 23 23 23 24 46 50 55 65 71 77 77 83 97 100 100 100	18.8 18.8 18.8 18.8 18.8 18.8 21.3 24.5 40.9 45.0 53.0 63.0 63.0 63.0 63.0 63.0 63.0 63.0 6	2920 7 27 68 83 100 143 184 222 259 292 243 341 357 308 247 170 100 59 25 27 20 20 20 20 20 20 20 20 20 20 20 20 20	54896 132 508 1053 1580 1993 2688 3919 5684 7615 10045 12897 15583 17480 18363 18992 17895 15561 11611 8022 4679 2045 573 164							
											-						
PLANT NO:		25		MASTER	CHILLER	NO (LE	AD):	-	38		MASTER	CHILLER	NO (LA	3 1):		37	 !
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO	DEL:	25 39015 980 0 EQ-2S	TONS %DSGN	MASTER COMPRI CONDER REFRIGI	ESSOR: ISER: ERANT:	3 NO (LE	AD):		38 CENT WATER R-123 NEW		COMPRI CONDET REFRIG STATUS	ESSOR: SER: ERANT:	NO (LAC	3 1);	************	37 CENT WATER R-123 NEW	
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND: CONSUMPTION:	DEL:	39015 980 0 EQ-2S 580.6 1271328	%DSGN KW KWHYR	COMPRI CONDEN REFRIGI STATUS CONFIG MAX LEA	ESSOR: SER: ERANT: : URATION AD SETPT	•	AD):	AD:	CENT WATER R-123 NEW SERIES/S	%	COMPRI CONDER REFRIG STATUS CONFIG MIN LAG	ESSOR: SER: ERANT: : URATION SETPOP	:	3 1):		CENT WATER R-123	SNQLE
BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND:	DEL:	39015 980 0 EQ-2S	%DSGN KW	COMPRICONDED REFRIGI STATUS CONFIG MAX LE/ LOAD LI	ESSOR: #SER: ERANT: : URATION AD SETPT MIT: CAPACITO	: For PRO-		AD:	CENT WATER R-123 NEW SERIES/S 80 100	% % TONS	COMPRI CONDER REFRIG STATUS CONFIG MIN LAG LOAD LI	ESSOR: SER: ERANT: : URATION SETPORMIT: CAPACITY	: VT:	3 1);		CENT WATER R-123 NEW SERIES/5 40 100	% TONS
BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT CO	ost:	39015 980 0 EQ-2S 580.6 1271328 \$88,500 \$30,512 \$119,111 \$122	KW KWHYR MR	COMPRI CONDET REFRIGI STATUS CONFIG MAX LE/ LOAD LI RATED (RATED 1	ESSOR: #SER: ERANT: : URATION AD SETPT MIT: CAPACITO	: or PRO- cy:	RATE LO		CENT WATER R-123 NEW SERIES/S 80 100 490.0 290.3 0.592	% % TONS KW KW/TON	COMPRI CONDER REFRIG STATUS CONFIG MIN LAG LOAD LI RATED (RATED (ESSOR: SER: ERANT: : URATION SETPORMIT: CAPACITY	: HT: f:	3 1):		CENT WATER R-123 NEW SERIES/: 40 100 490.0 290.3 0.592	% % TONS KW KW/TON
BULDING NO. DESIGN LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT CO W. PLAN PLANT LOAD DSGN LOAD	ST: PLANT LOAD SHED	39015 980 0 EQ-25 580.6 1271328 \$88.600 \$30.512 \$119,111 \$122 ANNUAL OCCUR ACTUAL	KW KWHYR / / / / / / / / / / / / / / / / / / /	COMPRISON CONDETER REFRIGION STATUS CONFIGURAL LOAD LI RATED I RATED I CHL LOAD	ESSOR: ISER: ERANT: : URATION AD SETPT MIT: CAPACITY POWER: EFFICIEN RAT CAP ACT	CY: SAP ADJ	RATE LO	POWER	CENT WATER R-123 NEW SERIES/S 80 100 490.0 290.3 0.592 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL ENERGY CONSUMP	COMPRI CONDET REFRIG STATUS CONFIG MN LAG LOAD LI RATED I RATED I RATED I	ESSOR: SER: ERANT: : URATION SETPORMIT: CAPACITY POWER: EFFICIEN RAT CAP	: VT: /:	% BAT POW	POWER	CENT WATER R-123 NEW SERIES/ 40 100 290.3 0.592 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL BNERGY CONSUMP
BULDING NO. DESIGN LOAD: WINTER LOAD: SIMULATION MO PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT CC W. PLAN PLANT LOAD DSGN LOAD TONS	ST: PLANT LOAD SHED	39015 980 0 EO-25 580.6 1271328 \$88.600 \$30.512 \$119,111 \$122 ANNUAL OCCUR	*LDSGN KW KWHYR //R //R //TONTYR PLANT	COMPRISONDED REFRIGION STATUS CONFIGMAX LEAL LOAD LI RATED OR RATED IN RA	ESSOR: ISER: ERANT: URATION AD SETPT MIT: CAPACITY POWER: EFFICIEN RAT CAP	cy:	RATELO		CENT WATER R-123 NEW SERIES/S 80 100 490.0 290.3 0.592 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY	COMPRII CONDER REFRIG STATUS CONFIG MIN LAG LOAD LI RATED I RATED I CHIL	ESSOR: SER: ERANT: : URATION ISETPOMMIT: CAPACITY POWER: EFFICIEN RAT CAP	: Y: CY:	% RAT	POWER	CENT WATER R-123 NEW SERIES/: 40 100 490.0 290.3 0.592 ANNUAL OCCUR	TONS KW KW/TON ANNUAL BNERGY

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

LANT N			28 39043	!	MASTER	CHILLER	NO (LEA	ND):		40	!	MASTER	CHILLER	NO (LAG	11):		39	
ULDING			1084	TONS	COMPRE	SSOR-				CENT	i	COMPRE	SSOR:				CENT	
ESIGN I			0	%DSGN	CONDEN					WATER	i	CONDEN	SER:				WATER	
		٠.	EQ-2S		REFRIGE					R-123	i	REFRIGE	RANT:				R-123	
MULAI	SON MODE	L'	EG-23		STATUS:					NEW	i	STATUS					NEW	
EAK DE	MAND:		688.4	KW j						SERIES/S		CONFIG	IDATION				SERIES/S	NO F
ONSUM	PTION:		1451490	KWH/YR]		URATION: D SETPT		RATELO	AD:	80	%	MINLAG	SETPOR				40	%
EMAND	COST:		\$105,050	/YR	LOAD LE	MIT:				100	% !	LOAD LE	AIT:				100	*
HERGY			\$34,836	/YR						560.0	TONS	DATED	APACIT	<i>/-</i>			560.0	TONS
OTAL C	OST:		\$139,886	∕/R	RATED	CAPACITY	r:			344.2	KW	RATED					344.2	KW
NIT OU	TPUT COS	T:	\$125	/TON"YR		FFICIEN	CY:			0.615	KW/TON	RATED E	FFICIEN	CY:			0.615	KW/TON
	PLANT	PLANT	ANNUAL	PLANT !	CHIL.	%	*	%	POWER	ANNUAL	ANNUAL	CHIL	%	%	%	POWER		ANNUAL
LANT	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	LOAD	RAT	RAT	RAT		OCCUR ADJUST	ENERGY
SON		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ALMUST	CONSUL
DAD						ACT	ADJ				!		ACT	ADJ				
4	TONS	TONS	HR/YR	кw	TONS	%	*	%	ĸw	HRYR	KWHYR	TONS	%	%	%	ĸw	HR/YR	KWH/YR
0 V	0.0	0.0	4380	0.0	0.0				0.0	0	0	0.0			0	0.0	0	
3 5		0.0	37	89.5	32.5	6	15	26	89.5	15	1343	0.0	0	0	0	0.0	0	
8 5		0.0	50	89.5	86.7	15	15	26	89.5	50	4475	0.0	0	0	0	0.0	0	
13 5		0.0	65	89.5	140.9	25	25	26	89.5	65	5818	0.0	0	0	0	0.0	0	
18 5		0.0	83	103.3	195.1	35	35	30	103.3	83	8574	0.0	0	0	0	0.0	0	
23 5		0.0	108	130.8	249.3	45	45	38	130.8	106	13865	0.0	0	0	0	0.0	0	
28 5	303.5	0.0	143	154.9	303.5	54	54	45	154.9	143	22151	0.0	0	0	0	0.0	0	
33 5	357.7	0.0	184	189.3	357.7	64	64	55	189.3	184	34831	0.0	0	0	0	0.0	ŏ	
38 5	411.9	0.0	232	223.7	411.9	74	74	65	223.7	232	51898	0.0	40	40	34	117.0	259	303
43 5	466.1	0.0	259	240.9	242.1	43	43	36	123.9	259	32090	224.0 224.0	40	40	34	117.0	292	341
48 5		0.0	292	288.4	296.3	53	53	44	151.4	292 343	44209 63764	224.0	40	40	34	117.0	343	401
53 5		0.0	343	302.9	350.5	63	63	54 63	185.9 216.8	343	82601	224.0	40	40	34	117.0	381	445
58 \$		0.0	381	333.8	404.7	72 52	72 52	43	148.0	388	57424	392.0	70	70	81	210.0	388	814
63 5		0.0	388	358.0	290.9	82	62	53	182,4	374	68218	392.0	70	70	61	210.0	374	785
68 5		0.0	374	392.4	345.1	62 71	71	62	213.4	357	76184	392.0	70	70	61	210.0	357	749
73 5			357 308	423.4 488.8	285.5	51	51	42	144.6	308	44537	560.0	100	100	100	344.2	308	1060
78 5			247	523.2	339.7	61	61	52	179.0	247	44213	560.0	100	100	100	344.2	247	850
83 5			171	554.2	393.9	70	70	61	210.0	171	35910	560.0	100	100	100	344.2	171	588
93 5		0.0	109	592.0	448.1	80	80	72	247.8	109	27010	580.0	100	100	100	344.2	109	375
	5 1008.1		59	836.8	502.3	90	90	85	292.6	59	17263	580.0	100	100	100	344.2	59	203
	5 1116.5		25	681.5	556.5	99	99	98	337.3	25	8433	580.0	100	100	100	344.2	25	8.6
	1170.7	50.7	7	889.4	560.0	100	100	100	344.2	7	2409	560.0	100	100	100	344.2	7	24
	1224.9	104.9	2	688.4	560.0	100	100	100	344.2	2	688	560.0	100	100	100	344.2	2	6
118	1279.1	159.1	0	688.4	580.0	100	100	100	344.2	0	. 0	560.0	100	100	100	344.2		
			8602		i					4200	747908						3322	7035

PLANT!	NO:			27	1	MASTER	CHILLER	NO (LEA	D):		41	
BUILDIN				41003	i							
DESIGN	110	DAD:		232	TONS	COMPRE					CENT	
NINTER	R L	DAD:		0	%DSGN	CONDEN					WATER	
ALUMI	TIC	N MODEL:		EQ-1	i	REFRIGE	RANT:				R-123	
			–			STATUS:					NEW	
EAK D	EM	AND:		157.4	KW I							
ONSU	MP	TION:		349825	KWHYR I	CONFIG	JRATION:				SINGLE	
					i	MAX LEA	DSETPT	or PRO-	RATELO	AD:	NA	%
EMAN	DO	OST:		\$24,019	∧vr i	LOAD LE	AIT:				100	%
NERG				\$8,396	∧r i							
OTAL				\$32,415	A/R	RATED	APACITY	' :			227.5	TONS
		•			i	RATED F	OWER:				157,4	KW
UNIT O	UTI	PUT COST:		\$142	/TON"YR	RATED E	FFICIEN	CY:			0.692	KW/TON
×		PLANT	PLANT	ANNUAL	PLANT	CHIL	*	*	~	POWER	ANNUAL	ANNUAL
THAP		LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
SON		-	SHED	ACTUAL	i		CAP	ÇAP	POW		ADJUST	CONSUM
OAD					į		ACT	ADJ				
۷.		TONS	TONS	HAYR	ĸw	TONS	%	%	%	KW	HRYR	KWHYR
	w	0.0	0.0	4380	0.0	0.0		0		0.0	0	
š	s	7.0	0.0	37	40.9	7.0	3	15	26	40.9	7	28
8	š	18.6	0.0	50	40.9	18.6	8	15	26	40.9	27	110
13	s	30.2	0.0	85	40.9	30.2	13	15	26	40.9	56	229
18	Š	41.8	0.0	83	40.9	41.8	18	18	26	40.9	83	339
23	Š	53.4	0.0	106	40.9	53.4	23	23	26	40.9	108	433
28	š	65.0	0.0	143	40.9	85.0	29	29	26	40.9	143	584
33	s	78.6	0.0	184	45.6	76.6	34	34	29	45.6	184	839
38	s	88.2	0.0	232	51.9	88.2	39	39	33	51.9	232	1204
43	s	99.B	0.0	259	58.2	99.8	44	44	37	58.2	259	1507
48	š	111.4	0.0	292	64.5	111.4	40	49	41	64.5	292	1883
53	s	123.0	0.0	343	70.8	123.0	54	54	45	70.8	343	2428
54	s	134.6	0.0	381	78.7	134.6	50	59	50	79.7	381	2998
63	S	148.2	0.0	388	86.6	146.2	64	64	55	86.6	388	3380
64	s	157.8	0.0	374	94.4	157.8	69	69	60	94.4	374	3536
73	s	169.4	0.0	357	102.3	189.4	74	74	65	102.3	357	3652
78	s	181.0	0.0	308	113.3	181.0	80	80	72	113.3	308	3489
83	s	192.6	0.0	247	122.8	192.6	85	85	78	122.8	247	3033
88	s	204.2	0.0	171	133.8	204.2	90	90	85	133.8	171	228
93	š	215.8	0.0	109	144.8	215.8	95	95	92	144.8	109	1578
98	s	227.4	0.0	59	157.4	227.4	100	100	100	157.A	59	928
103	s	239.0	11.5	25	157.4	227.5	100	100	100	157.4	25	393
108	s	250.6	23.1	7	157.4	227.5	100	100	100	157.4	7	110
113	Š	282.2	34.7	2	157.4	227.5	100	100	100	157.4	2	3
118		273.8	46.3	ō	157.4	227.5	100	100	100	157.4	0	
				8602							4160	34982

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT NO	0:		28		MASTE	CHILLE	RNOAE	ADV:		42	
BULDING	NO:		42000				. 140 (LL	ADJ.			
DESIGN L			189	TONS %DSGN	COMPR					CENT	
	ION MODEL		EQ-1	AUSCRI	CONDE					WATER R-123	
					STATUS					NEW	
PEAK DE			127.0	KW							
CONSUM	PHORE		275936	KWH/YR		URATION AD SETP		DATELO	AD:	SINGLE	%
DEMAND	COST:		\$19,380	ΛΆΒ	LOAD L		· u · no	MILLE	AD.	100	*
ENERGY			\$6,622	ΛΉ							
TOTAL CO	OST:		\$28,003	ΛΆ	RATED	CAPACIT POWER:	Y :			188.1	TONS
UNITOUT	PUT COST:		\$138	/TON*YR		EFFICIEN	CY:			127.0 0.875	KW/TON
%	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
PLANT	LOAD	LOAD	ACTUAL	DEMMO	LOAD	CAP	RAT	RAT POW		OCCUR	CONSUMP
LOAD		SHED	ACTORE			ACT	ADJ	POW		ADJUST	CONSUMP
%	TONS	TONS	HRYR	KW	TONS	%	%	%	KW	HR/YR	KWH/YR
0 W	0.0	0.0	4380	0.0	0.0				0.0	0	0
3 \$	5.7	0.0	37	33.0	5.7	3	15	26	33.0	7	231
8 S		0.0	50	33.0	15.1	8	15	26	33.0	27	891
13 S	24.6 34.0	0.0 0.0	65 83	33.0 33.0	24.6 34.0	13	15	26	33.0	58	1848
23 5	43.5	0.0	108	33.0	43.5	18	18	26 26	33.0 33.0	83 106	2739 3498
28 S	52.9	0.0	143	33.0	52.9	28	28	26	33.0	143	4719
33 S		0.0	184	35.8	62.4	33	33	28	35.6	184	6550
38 S 43 S	71.8 81.3	0.0	232 259	40.6 45.7	71.8 81.3	38	38	32	40.6	232	9419
43 S		0.0	259 292	45.7 50.8	90.7	43 48	43 48	36 40	45.7 50.8	259 292	11836 14834
53 S	100.2	0.0	343	55.9	100.2	53	53	44	55.9	343	19174
58 S	109.6	0.0	381	62.2	109.6	58	58	49	62.2	381	23698
63 S 68 S	119.1 128.5	0.0	388 374	68.6	119.1	63	63	54	68.6	388	26617
73 S	128.5	0.0	357	74.9 81.3	128.5 138.0	68 73	68 73	59 64	74.9 81.3	374 357	28013 29024
78 S	147.4	0.0	308	88.9	147.4	78	78	70	88.9	308	27381
83 S	158.9	0.0	247	98.5	156.9	83	83	78	96.5	247	23836
88 S 93 S	166.3 175.8	0.0 0.0	171 109	104.1 113.0	166.3 175.8	88 93	88 93	82 89	104.1 113.0	171	17801
98 \$	185.2	0.0	59	121.9	185.2	98	98	98	113.0	109 59	12317 7192
103 S	194.7	6.6	25	127.0	188.1	100	100	100	127.0	25	3175
108 S 113 S	204.1 213.6	18.0 25.5	7	127.0	188.1	100	100	100	127.0	7	889
118 S	223.0	34.9	0	127.0 127.0	188.1 188.1	100	100 100	100	127.0 127.0	0	254 0
				121.0	100.1		100	100	127.0		
			8602	 						4160	275938
PLANT NO BUILDING			29 50001		MASTER	CHILLER	NO (LEA	(D):		43	
DESIGN L			129	TONS	COMPRE	SSOR:				CENT	
WINTER L	OAD:		20	%DSGN	CONDEN					WATER	
SIMULATIO	ON MODEL		EQ-1	1	REFRIG					R-123	
PEAK DE	JAND-		87.2	KW	STATUS:					NEW	
CONSUME			288903	KWHYR	CONFIG	JRATION:				SINGLE	
			200000		MAXILEA			RATELO	AD:	NA	%
DEMAND			\$13,307	MR I	LOAD LE	AIT:				100	%
TOTAL CO			\$6,934 \$20,240	AAB I	RATED C	4 DA CITA	r.			100.0	TONO
10172	701.		\$20,240	///	BATEDE		•			129.2 87.2	TONS KW
UNIT OUT	PUT COST:		\$157	/TON"YR	RATED E		CY:			0.675	KW/TON
*	PLANT	PLANT	ANNUAL	PLANT	CHIL.	~~~ -	·-	×	POWER	ANNUAL	
PLANT	LOAD	LOAD	OCCUR		WI I Re						
DSGN				DEMAND	LOAD	RAT	RAT	RAT	1011411		ANNUAL ENERGY
		SHED	ACTUAL	DEMOND	LOAD	RAT	CAP		1000	OCCUR ADJUST	
LOAD				JEMANU	LOAD	RAT		RAT	1000	OCCUR	ENERGY
	TONS			KW	TONS	RAT	CAP	RAT	ĸw	OCCUR	ENERGY
% 20 W	25.8	TONS	HR/YR 4380	KW	TONS	RAT CAP ACT	CAP ADJ % 20	RAT POW	KW 22.7	OCCUR ADJUST HR/YR 4380	ENERGY
20 W	25.8 3.9	TONS 0.0 0.0	HR/YR 4380 37	KW 22.7 22.7	TONS 25.8	RAT CAP ACT %	CAP ADJ % 20 15	RAT POW	KW 22.7 22.7	OCCUR ADJUST HR/YR 4380 7	ENERGY CONSUMP KWH/YR 99426 159
% 20 W	25.8	TONS 0.0 0.0 0.0	HR/YR 4380 37 50	KW 22.7 22.7 22.7	TONS 25.8 3.9 10.3	RAT CAP ACT %	CAP ADJ % 20 15 15	RAT POW % 26 28 28	22.7 22.7 22.7 22.7	HRVYR 4380 7 27	ENERGY CONSUMP KWH/YR 99428 159 613
20 W 3 S 8 S 13 S 18 S	25.8 3.9 10.3 16.8 23.2	TONS 0.0 0.0 0.0 0.0 0.0	ACTUAL HR/YR 4380 37 50 65 83	22.7 22.7 22.7 22.7 22.7 22.7	25.8 3.9 10.3 16.8 23.2	RAT CAP ACT % 20 3 8 13	20 15 15 15 18	RAT POW	KW 22.7 22.7	OCCUR ADJUST HR/YR 4380 7	ENERGY CONSUMP KWH/YR 99426 159
20 W 3 S 8 S 13 S	25.8 3.9 10.3 16.8	TONS	HR/YR 4380 37 50 65	KW 22.7 22.7 22.7 22.7	25.8 3.9 10.3 16.8 23.2 29.7	RAT CAP ACT % 20 3 8 13	20 15 15 15 18 23	26 28 28 26 26 26 26	22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108	ENERGY CONSUMP KWH/YR 99426 159 613 1271 1884 2406
20 W 3 S 8 S 13 S 18 S 23 S 28 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 65 83 108 143	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	25.8 3.9 10.3 16.8 23.2 29.7 38.1	RAT CAP ACT % 20 3 8 13 18 23 28	CAP ADJ % 20 15 15 15 18 23 28	RAT POW % 26 28 28 26 26 26 26 26 26 26	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108 143	ENERGY CONSUMP KWH/YR 99426 159 613 1271 1884 2406 3248
20 W 3 S 8 S 13 S 23 S 28 S 33 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0	TONS	ACTUAL HR/YR 4380 37 50 65 83 108 143 184 232	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9	25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0	RAT CAP ACT % 20 3 8 13 18 23 28 33 38	CAP ADJ % 20 15 15 15 18 23 28 33 38	26 28 28 26 26 26 26	22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108	ENERGY CONSUMP KWH/YR 99428 159 613 1271 1884 2408 3248 4490
20 W 3 S 8 S 13 S 23 S 28 S 33 S 34 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 65 83 108 143 184 232 259	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4	25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5	RAT CAP ACT \$\frac{20}{3}\$ 8 13 18 23 28 33 38 43	CAP ADJ % 20 15 15 15 18 23 28 33 38 43	RAT POW % 28 28 28 26 26 26 28 28 32 36	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 106 143 184 232 259	ENERGY CONSUMP 89428 159 613 1271 1884 2408 3248 4490 6473 8133
20 W 3 S 8 S 13 S 23 S 28 S 33 S 34 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	4380 37 50 65 83 106 143 184 232 259 292	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9	25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5 61.9	RAT CAP ACT % 20 3 8 13 18 23 28 33 38 43 48	CAP ADJ % 20 15 15 15 18 23 28 33 38 43 48	RAT POW % 26 26 28 28 28 28 28 28 28 28 28 32 32 36 40	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HRVR 4380 7 27 56 83 106 143 184 232 259 292	ENERGY CONSUMP KWH/YR 99428 159 613 1271 1884 2408 3248 4490 8473 8133 10191
20 W 3 S 8 S 13 S 28 S 28 S 33 S 34 S S 48 S S 58 S 58 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.8	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 65 83 108 143 184 232 259	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9	RAT CAP ACT % 20 3 8 13 18 23 28 33 38 43 48 53	CAP ADJ % 20 15 15 15 18 23 28 33 38 43 48 53	RAT POW % 28 28 28 26 26 26 28 28 32 36	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ACJUST HR/YR 4380 7 27 56 83 108 143 184 232 259 292 343	ENERGY CONSUMP 89428 159 613 1271 1884 2406 3246 4400 6473 8133 10191 13171
20 W 3 S 8 S 13 S 28 S 28 S 33 S 34 S S 48 S S 58 S 58 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.8	SHED TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 85 83 108 143 184 232 259 292 343 381 388	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3	RAT CAP ACT % 20 3 8 13 18 23 28 33 38 43 48 53 58 63	CAP ADJ % 20 15 15 15 18 23 28 33 38 43 48 53 58 63	RAT POW % 28 28 28 28 28 28 28 28 28 32 36 40 44 49 54	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108 143 184 232 259 259 343 381 388	ENERGY CONSUMP KWHYR 99428 159 613 1271 1884 2408 3248 4490 8473 8133 10191 13171 16269 18275
20 W 3 S S 13 S S 13 S S 33 S S 343 S S 543 S S 558 S S 653 S S 653 S S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3 87.7	TONS	4380 37 50 65 83 108 143 184 232 259 292 343 381 388 374	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.4	TONS 25.8 3.9 10.9 16.8 23.2 29.7 36.1 42.6 42.6 45.5 61.9 81.3 87.7	RAT CAP ACT \$\frac{20}{3}\$ & \$\frac{8}{18}\$ & \$23\$ & \$23\$ & \$38\$ & \$43\$ & \$58\$ & \$58\$ & \$68\$ & \$68\$ & \$68\$	20 15 15 15 18 23 33 38 43 48 53 58 63	RAT POW 26 28 28 28 26 26 26 26 28 30 30 44 49 54	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 7 27 56 83 108 143 184 232 259 292 343 381 388 374	ENERGY CONSUMP WWH/YR 99426 159 613 1271 1884 2406 3246 4490 6473 8133 10191 13171 16269 18275 19224
20 W 3 5 8 5 13 5 23 5 23 5 23 5 24 5 5 3 5 63 5 63 5 73 5 73 5 73 5 73 5 7	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3 87.7 94.2	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 4380 37 50 65 83 108 143 184 232 259 292 343 381 386 374	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 34.9 38.4 42.7 47.1 51.4 55.8	TONS 25.8 3.9 10.3 16.8 23.2 29.7 36.1 49.0 55.5 61.9 68.4 74.8 81.3 87.7 94.2	RAT CAP ACT 20 3 8 8 13 18 23 28 33 38 48 53 63 63 63 67 73	CAP ADJ % 20 15 15 15 15 18 23 28 33 38 43 48 53 53 63 63 73	RAT POW 28 28 28 28 28 28 28 28 28 32 36 40 44 49 54 59 64	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108 143 232 259 292 343 381 388 374 357	ENERGY CONSUMP 99428 159 613 1271 1884 2408 3248 4490 6473 8133 10191 13177 16269 18275 19224 19921
20 W 3 5 8 5 13 S 18 S 23 S 28 S 39 S 49 S 50 S 69 S 69 S 69 S 69 S 69 S 69 S 69 S 6	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 55.5 61.9 88.4 74.8 81.3 97.7 94.2 100.6	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	4380 37 50 65 83 108 143 184 232 259 292 343 381 388 374	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.4	TONS 25.8 3.9 10.9 16.8 23.2 29.7 36.1 42.6 42.6 45.5 61.9 81.3 87.7	RAT CAP ACT \$\frac{20}{3}\$ & \$\frac{8}{18}\$ & \$23\$ & \$23\$ & \$38\$ & \$43\$ & \$58\$ & \$58\$ & \$68\$ & \$68\$ & \$68\$	20 15 15 15 18 23 33 38 43 48 53 58 63	RAT POW 26 28 28 28 26 26 26 26 28 30 30 44 49 54	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 68 3 108 143 184 232 259 292 343 381 388 374 357 308	ENERGY CONSUMP 99426 159 613 1271 18846 2406 3246 4490 6473 8133 10191 13171 10289 18275 10224 19921
20 W 3 5 8 5 13 5 28 5 28 5 28 5 5 5 5 5 5 5 6 5 5 7 8 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 5 5 8 8 8 5 5 8 5 5 7 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 8 5 5 7 8 5 5 5 8 5 5 5 8	25.8 3.9 10.3 18.8 23.2 29.7 36.1 42.6 49.5 51.9 68.4 74.2 100.6 107.1 113.5	TONS	ACTUAL HR//R 4380 37 50 65 83 10e 144 232 259 292 343 381 388 374 357 300 247	XW	70NS 25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 48.0 87.7 94.2 100.8 107.1 113.5	RAT CAP ACT % 20 3 8 13 13 13 23 23 23 34 48 53 58 67 37 78 88 88	CAP ADJ % 20 15 15 15 15 18 23 33 38 43 43 48 53 63 63 63 63 88 88	RAT POW % 28 28 28 28 28 28 28 29 30 44 49 54 59 64 70 78 82	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HRYR 4380 7 27 56 83 108 143 184 232 259 292 243 381 388 374 357 308 247 171	ENERGY CONSUMP 99426 159 613 1271 1884 2406 3248 4490 6473 8133 10191 13171 10289 10274 1921 19224 1921 13788 16378 16378
20 W 3 5 8 5 13 S 18 S 28 S 34 S 5 63 S 5 63 S 63 S 63 S 63 S 63 S 63	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 49.0 10.7 14.8 81.7 94.8 10.7 11.1 11.1 11.1 11.1 11.1 11.1 11.1	TONS	ACTUAL HR/VR 4380 37 50 65 83 108 143 1242 259 202 244 381 388 374 47 377 170	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.4 55.8 61.0 68.3 71.5 77.8	70NS 25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 68.4 74.8 81.3 87.7 94.2 100.6 107.1 113.5	RAT CAP ACT 20 3 8 13 18 23 28 43 48 43 48 63 68 73 68 69 39 39 39	CAP ADJ % 20 15 16 15 18 23 28 33 38 43 48 53 58 63 63 63 63 88 78 83 88 93	RAT POW 28 28 28 28 28 28 28 32 36 40 44 45 59 84 70 78 89 99	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR AUJUST HR/YR 4380 7 27 56 83 106 143 184 232 259 292 343 381 388 374 357 308 247 171 109	ENERGY CONSUMP WHYR 99426 159 613 1271 1884 2406 2246 4473 8133 10191 13171 16289 18275 19221 1978 1978 1978 1978 1978 1978 1978 197
20 W 3 S S 18 S S S S S S S S S S S S S S S S	25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5 61.9 88.4 74.8 97.7 100.6 107.1 113.5 120.0	TONS	ACTUAL HR/VR 4380 37 50 65 83 106 144 232 259 202 243 381 388 374 357 308 247 171 100 55	XW	TONS 25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 42.6 43.8 74.8 81.3 87.7 94.2 100.6 107.1 113.5 120.0 126.4	RAT CAP ACT % 20 3 8 8 13 23 28 23 38 63 68 63 68 63 88 98	CAP ADJ % 20 15 15 15 18 23 33 38 43 43 45 53 63 73 78 88 83 83 98	RAT POW % 28 28 28 28 26 26 28 30 34 40 44 49 54 70 78 82 89 96	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ADJUST HR/YR 4380 7 27 56 83 108 143 232 259 292 343 381 388 374 357 308 247 171 109 59	ENERGY CONSUMP 99428 159 613 1271 1884 4490 4473 8133 10191 13171 10289 16275 10224 19921 1878 16378 1
20 W 3 S 13 S 13 S 23 S 23 S 23 S 23 S 5 58 S 5 58 S 5 78 S 83 S 78 S 78 S 78 S 78 S 78 S 78 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 49.0 10.7 14.8 81.7 94.8 10.7 11.1 11.1 11.1 11.1 11.1 11.1 11.1	TONS	ACTUAL HR/VR 4380 37 50 65 83 108 143 1242 259 202 244 381 388 374 47 377 171 100	XW 1 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 34.9 47.1 51.4 55.8 61.0 68.3 71.5 77.8 61.0 68.3 71.5 78.2	TONS 25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3 87.7 94.2 100.6 107.1 113.5 120.0 126.4 129.2	RAT CAP ACT	CAP ADJ % 20 16 15 15 18 23 28 33 38 43 48 53 53 63 63 63 63 63 63 63 63 63 63 63 63 63	RAT POW ** 28 28 28 28 28 28 28 28 39 36 40 44 49 54 59 84 70 78 82 89 98 100	22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.8 61.0 66.3 71.5 68.3 71.5 68.3 71.5 68.3	OCCUR ACJUST HR/YR 4380 7 27 56 83 108 143 232 259 292 243 381 388 374 357 308 247 171 109 59 25	ENERGY CONSUMP WHYR 99428 159 613 1271 1884 2406 3246 4473 8133 10191 13171 16289 18275 19221 19788 18378 18275 19221 19788 18378 1847
LOAD % 20 W 3 S S 8 S 13 S S 13 S S 23 S S 23 S S 34 S S 54 S S 55 S S 55 S S 55 S S S 55 S S S S	25.8 3.9 10.3 18.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 88.4 81.7 94.2 100.6 107.1 113.5 120.0 126.4 192.9 139.3	TONS	ACTUAL HR/YR 4380 37 50 65 83 108 144 222 259 343 381 388 374 357 308 247 1100 56 7 2	XW 1 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 23.4 34.9 38.4 42.7 47.1 51.4 55.8 61.0 66.3 71.5 71.8 87.2 87.2 87.2 87.2 87.2	TONS 25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3 87.7 94.2 100.6 107.1 113.5 120.0 126.4 129.2 129.2	RAT CAP ACT % 3 8 13 18 23 28 33 28 43 43 43 45 53 58 63 68 73 78 88 93 98 100 100 100 100 100 100 100 100 100 10	CAP ADJ % 20 15 15 15 15 23 28 23 39 48 53 58 63 63 63 83 93 88 93 100 100	RAT POW % 28 28 28 28 28 28 28 28 32 38 44 49 54 59 64 70 78 82 89 96 100 100	22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.8 61.0 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 71.6 71.6 71.6 71.6 71.6 71.6 71.6	OCCUR ACJUST HR/YR 4380 7 27 56 83 108 143 232 259 202 343 381 381 381 374 357 308 277 100 50 50 50 50 50 50 50 50 50 50 50 50 5	ENERGY CONSUMP 89428 159 613 1271 1884 2406 3246 4490 4473 8133 10191 13171 16289 18275 1921 1878 1838 18275 1921 1878 493 18275 1827
20 W 3 S 13 S 13 S 23 S 23 S 23 S 23 S 5 58 S 5 58 S 5 78 S 83 S 78 S 78 S 78 S 78 S 78 S 78 S	25.8 3.9 10.3 16.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 68.4 74.6 81.3 87.7 94.2 100.6 107.1 113.5 120.0 126.4 132.9 139.9	TONS	ACTUAL HR/YR 4380 37 50 65 83 106 143 184 232 259 292 243 381 388 374 3574 357 308 2477 100 55 25 7	XW	70NS 25.8 3.9 10.8 16.8 23.2 29.7 36.1 42.6 40.0 55.5 61.9 68.4 74.8 81.3 87.7 2100.8 107.1 113.5 120.0 126.4 129.2	RAT CAP ACT % 20 3 4 8 13 23 28 28 43 28 53 28 68 73 78 88 89 98 100 100 100 100	CAP ADJ % 20 15 15 18 23 28 33 43 43 43 45 53 53 53 63 63 63 83 73 78 83 83 98 98 100 100	RAT POW ** 28 28 28 28 28 28 28 28 30 40 44 49 54 70 78 82 99 61 100	22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7	OCCUR ACJUST HR/YR 4380 7 27 56 83 108 143 232 259 243 381 388 374 357 771 100 59 257	ENERGY CONSUMP 99426 159 613 1271 1884 2406 3246 3248 4490 6473 10191 13171 10259 10275 10224 19921 1878a 1833 1033 1033 1033 1033 1033 1033 1033
LOAD % 20 W 3 S S 8 S 13 S S 13 S S 23 S S 23 S S 34 S S 54 S S 55 S S 55 S S 55 S S S 55 S S S S	25.8 3.9 10.3 18.8 23.2 29.7 36.1 42.6 49.0 55.5 61.9 88.4 81.7 94.2 100.6 107.1 113.5 120.0 126.4 192.9 139.3	TONS	ACTUAL HR/YR 4380 37 50 65 83 108 144 222 259 343 381 388 374 357 308 247 1100 56 7 2	XW 1 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 22.7 23.4 34.9 38.4 42.7 47.1 51.4 55.8 61.0 66.3 71.5 71.8 87.2 87.2 87.2 87.2 87.2	TONS 25.8 3.9 10.3 16.8 23.2 29.7 38.1 42.6 49.0 55.5 61.9 68.4 74.8 81.3 87.7 94.2 100.6 107.1 113.5 120.0 126.4 129.2 129.2	RAT CAP ACT % 3 8 13 18 23 28 33 28 43 43 43 45 53 58 63 68 73 78 88 93 98 100 100 100 100 100 100 100 100 100 10	CAP ADJ % 20 15 15 15 15 23 28 23 39 48 53 58 63 63 63 83 93 88 93 100 100	RAT POW % 28 28 28 28 28 28 28 28 32 38 44 49 54 59 64 70 78 82 89 96 100 100	22.7 22.7 22.7 22.7 22.7 22.7 22.7 24.4 27.9 31.4 34.9 38.4 42.7 47.1 51.8 61.0 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 68.3 71.6 71.6 71.6 71.6 71.6 71.6 71.6 71.6	OCCUR ACJUST HR/YR 4380 7 27 56 83 108 143 232 259 202 343 381 381 381 374 357 308 277 100 50 50 50 50 50 50 50 50 50 50 50 50 5	ENERGY CONSUMP WH-LYR 99428 159 813 1271 1884 2406 3246 4450 6473 8133 10191 13177 16299 18275 19224 19921 18788 8138 610 610 174

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT N	10:			30	I	MASTER	CHILLER	NO (LEA	ND):		44	
BULDIN	GN			50004	i						CENT	
DESIGN				306	TONS	COMPRE					WATER	
WINTER				20	%DSGN	CONDEN					R-123	
SIMULA	TIO	MODEL:		EQ-1	!	REFRIGE STATUS:					NEW	
PEAK D	- I	ND:		198.0	KW I	SIATUS.						
CONSU				655812	KWHYR	CONFIGI					SINGLE	
					i	MAX LEA	D SETPT	or PRO-	RATELO	AD:	NA .	*
DEMAN	$D \propto$	OST:		\$30,215	MR	LOAD LIF	MIT:				100	%
ENERGY	rα	ST:		\$15,739	MR I							Tana
TOTAL (cos	T:		\$45,954	WB I		APACIT	r:			306.0 198.0	TONS
				****	/TON"YR	RATED	FFICIEN	cv.			0.647	KW/TON
UNIT OL	יידונ	JT COST:		\$150	/ION TH	MAIED						
*	1	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
PLANT		OAD	LOAD	OCCUR	DEWND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
DSGN			SHED	ACTUAL	1		CAP	CAP	POW		ADJUST	CONSUMP
LOAD							ACT	ADJ				
%	•	TONS	TONS	HRYR	kw i	TONS	*	%	%	KW	HRYR	KWHYR
20	w	61.2	0.0	4380	51.5	61.2	20	20	26	51.5	4380	225570
	s	9.2	0.0	37	51.5	9.2	3	15	26	51.5	7	361
	s	24.5	0.0	50	51.5			15	26	51.5	27	1391
13	s	39.8	0.0	65	51.5	39.8	13	15	26	51.5	56	2884
	Š	55.1	0.0	83	51.5	55.1	18	18	26	51.5	83	4275
23	s	70.4	0.0	106	51.5	70.4	23	23	28	51.5	108	5459
28	s	85.7	0.0	143	51.5	85.7	28	28	26	51.5	143	7365
33	s	101.0	0.0	184	55.4	101.0	33	33	28	55.4	184	10194
38	s	116.3	0.0	232	63.4		38	38	32	63.4	232	14709
43	\$	131.6	0.0	259	71.3		43	43	36	71.3	259	18467
48	S	146.9	0.0	292	79.2	146.9	48	48	40	79.2	292	23126 29875
	S	162.2	0.0	343	87.1	162.2	53	53	44	87.1	343 381	38957
	S	177.5	0.0	381	97.0	177.5	58	58	49	97.0	388	41477
	s	192.8	0.0	388	106.9	192.8	63	63 68	54 59	108.9 116.8	374	43683
	s	208.1	0.0	374	118.8	208.1	68 73	73	64	126.7	357	45232
	s	223,4	0.0	357	126.7	223.4 238.7	73	78	70	138.6	308	42886
	S	238.7	0.0	308	138.6 150.5	254.0	83	83	76	150.5	247	37174
	S	254.0	0.0	247 171	162.4	269.3	88	88	82	162.4	171	27770
	S	269.3	0.0	109	176.2	284.6	93	93	89	178.2	109	19206
	S	284.6	0.0	109	190.1	299.9	98	98	96	190.1	59	11216
	s	299.9	9.2	25	198.0	306.0	100	100	100	198.0	25	4950
103	S	315.2 330.5	24.5	7	198.0	308.0	100	100	100	198.0	7	1386
108	S	345.8	39.8	2	198.0	306.0	100	100	100	198.0	2	396
113 118	5	345.8	55.1	0	198.0	306.0	100	100	100	198.0	ō	
				8602							8540	655812

LANT NO:			31 87018	!	MASTER	CHILLER	NO (LEA	D):		48	1	MASTER	CHILLER	NO (LA	9 1):		47	
UILDING NO			902	TONS	COMPRE	econ.				CENT	i	COMPRE	SSOR:				CENT	
ESIGN LOA			902	%DSGN	CONDEN					WATER	i	CONDEN					WATER	
INTER LOA			•	76USUN	REFRIGE					R-123		REFRIGI					R-123	
MULATION	MODEL:		EQ-2S		STATUS:					NEW	i	STATUS					NEW	
EAK DEWAY			559.2	KW						SERIES/S		CONFIG					SERIES/S	NGI E
ONSUMPTN	ION:		1152030	KWH/YR	CONFIGI MAX LEA			DATELO	40.	SERIES/5	%	MIN LAG					40	%
EMAND CO	CT.		\$85,334	//R	LOAD LE		or PhO-	MAIELO	ND.	100	~ i	LOAD LE					100	%
NERGY CO			\$27,649	MB I	EOND LE						i							
OTAL COST			\$112,983	N/R	RATED C	APACITY	/ :			474.0	TONS		CAPACIT	Y:			474.0	TONS
•				i	RATED F					279.6	KW	RATED		***			279.6	KW/TON
NIT OUTPU	JT COST:		\$119	/TONTYR	RATED E	FFICIEN	CY:			0.590	KW/TON	RATED	FFICIEN	CY:			0.590	KW/10N
. P	LANT	PLANT	ANNUAL	PLANT I	CHIL	-%	%	%	POWER	ANNUAL	ANNUAL	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
	OAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
SGN		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSU
DAD						ACT	ADJ				1		ACT	ADJ				
T	ONS	TONS	HR/YR	KW 1	TONS	%	%	%	KW	HRYR	KWH/YR	TONS	%	%	%	KW	HR/YR	KWH/YR
0 W	0.0	0.0	4380	0.0	0.0				0.0	0	0 1	0.0	0	0	0	0.0	0	
3 5	27.1	0.0	37	72.7	27.1	6	15	26	72.7	15	1091	0.0	0	0	0	0.0	0	
8 5	72.2	0.0	50	72.7	72.2	15	15	26	72.7	50	3635	0.0	0	0	0	0.0	0	
13 5	117.3	0.0	65	72.7	117.3	25	25	26	72.7	65	4726	0.0	0	0	0	0.0	0	
18 S	182.4	0.0	83	81.1	162.4	34	34	29	81.1	83	6731	0.0	0	0	0	0.0	0	
23 S	207.5	0.0	106	103.5	207.5	44	44	37	103.5	106	10971	0.0	0	0	0	0.0	0	
28 S	252.6	0.0	143	123.0	252.6	53	53	44	123.0	143	17589	0.0	0	0	0	0.0	0	
33 S	297.7	0.0	184	151.0	297.7	63	63	54	151.0	184	27784	0.0	0	0	0	0.0	0	
38 S	342.8	0.0	232	176.1	342.8	72	72	63	176.1	232	40855	0.0	0	0	0	0.0	0	
43 S	387.9	0.0	259	193.0	198.3	42	42	35	97.9	259	25356	189.6	40	40	34	95.1	259	24
48 5	433.0	0.0	292	212.5	243.4	51	51	42	117.4	292	34281	189.6	40	40	34	95.1	292	27
53 S	478.1	0.0	343	240.5	288.5	61	61	52	145.4	343	49872	189.6	40	40	34	95.1	343	32
58 S	523.2	0.0	381	265.7	333.8	70	70	61	170.6	381	64999	189.6	40	40	34	95.1	381 388	36
63 5	568.3	0.0	388	298.4	378.7	80	80	72	201.3	388	78104	189.8	40	40	34 61	95.1 170.8	388	63
88 S	613.4	0.0	374	310.4	281.6	59	59	50	139.8	374	52285	331.8	70 70	70 70	61	170.6	357	60
73 S	658.5	0.0	357	338.4	326.7	69	69	60	167.8	357	59905	331.8	70	70	61	170.6	308	52
78 S	703.6	0.0	308	388.3	371.8	78	78	70	195.7	308	60276	331.8 474.0	100	100	100	279.6	247	89
83 S	748.7	0.0	247	416.6	274.7	58	58	49	137.0	247	33839	474.0	100	100	100	279.6	171	47
88 5	793.8	0.0	171	441.8	319.8	67	67	58	162.2	171	27736	474.0	100	100	100	279.6	109	30
93 S	838.9	0.0	109	472.5	364.9	77	77	69	192.9	109	21026	474.0	100	100	100	279.6	59	16
98 5	884.0	0.0	59	503.3	410.0	86	86	80	223.7	59	13198	474.0	100	100	100	279.6	25	8
103 \$	929.1	0.0	25	539.6	455.1	96	98	93	260.0	25	6500 1 1957	474.0	100	100	100	279.6	7	1
108 S	974.2	28.2	7	559.2	474.0	100	100	100	279.8	7			100	100	100	279.6	,	'
	1019.3	71.3	2	559.2	474.0	100	100	100	279.6 279.6	2	559 0	474.0 474.0	100	100	100	279.6	0	
118 S	1084.4	116.4	0	559.2	474.0	100	100	100	219.0			4,4.0	.50	.50		2	3322	508
			8602		Į.					4200	643275	i					3322	508

Table I-2. ECO-1 Calculation of Chiller Energy Cost for New Conditions

PLANT N			32	1	MASTER	CHILLE	ANO (LE	AD):		49	
BULDIN			91001	1							
DESIGN			123	TONS	COMPR					CENT	
WINTER			0	% DSGN	CONDE					WATER	
SIMULAT	TON MODEL	:	EQ-1	i	REFRIG	ERANT:				R-123	
					STATUS					NEW	
PEAK DE			83.3	KW							
CONSUM	PTION:		183341	KWHYR j	CONFIG	URATION	t:			SINGLE	
				j	MAX LE	AD SETP	or PRO	RATELO	AD:	NA	%
DEXAND	COST:		\$12,712	AVR I	LOAD LI	MIT:				100	%
ENERGY			\$4,400	AVR I							
TOTAL C	OST:		\$17,112	MR į		CAPACIT	Y:			121.8	TONS
				i	RATED	POWER:				83.3	KW
UNIT OU	TPUT COST:		\$140	/TONTYR	RATED I	EFFICIEN	CY:			0.684	KW/TON
×	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	*	~	POWER	ANNUAL	ANNUAL
PLANT	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
DSGN		SHED	ACTUAL	i		CAP	CAP	POW		ADJUST	CONSUMP
LOAD				į		ACT	ADJ				
*	TONS	TONS	HR/YR	kw	TONS	%	%	%	KW	HRYR	KWHYR
0 W		0.0	4380	0.0	0.0				0.0		
3 5	3.7	0.0	37	21.7		3	15	26	21.7	7	152
8 S	9.8	0.0	50	21.7	9.8	8	15	26	21.7	27	586
13 S		0.0	85	21.7	16.0	13	15	26	21.7	58	1215
18 S		0.0	83	21.7	22.1	18	18	26	21.7	83	1801
23 S		0.0	106	21.7	28.3	23	23	28	21.7	106	2300
28 S		0.0	143	21.7	34.4	28	28	26	21.7	143	3103
33 S		0.0	184	23.3	40.8	33	33	28	23.3	184	4287
38 S		0.0	232	26.7	46.7	38	38	32	28.7	232	6194
43 S		0.0	259	30.0	52.9	43	43	36	30.0	259	7770
48 S		0.0	292	33.3	59.0	7	42	40	33.3	292	9724
53 S		0.0	343	37.5	65.2	54	54	45	37.5	343	12863
58 S		0.0	381	41.7	71.3	59	59	50	41.7	381	15888
83 S		0.0	388	45.8	77.5	84	64	55	45.8	388	17770
68 S		0.0	374	50.0	83.6	69	69	60	50.0	374	18700
73 S		0.0	357	54.1	89.8	74	74	65	54.1	357	19314
78 5		0.0	308	59.1	95.9	79	79	71	59.1	308	18203
M3 S		0.0	247	64.1	102.1	84	84	77	84.1	247	15833
48 S		0.0	171	89.1	108.2	89	89	83	69.1	171	11816
93 S		0.0	109	75.0	114.4	94	94	90	75.0	109	8175
98 5		0.0	59	81.6	120.5	99	99	98	81.6	59	4814
103 5		4.9	25	83.3	121.8	100	100	100	83.3	25	2083
108 S		11.0	7	83.3	121.8	100	100	100	83.3	7	583
113 S		17.2	2	83.3	121.8	100	100	100	83.3	2	167
118 S		23.3	ō	83.3	121.8	100	100	100	83.3	ő	107
			8602	- 1						4180	183341

Table I-3. ECO-1 Calculation of Revised Chiller Energy Cost with Load Limits

																		<u></u>
LANT N	~				MASTER	CHILLERN	O (LEAD): 		6	!	MASTER (HILLER N	10 (LAG 1):		7	
ULDING			410	i							1							
ESIGN L			238	TONS	COMPRES	SSOR:				CENT	1	COMPRES					CENT	
INTER			0	%DSGN	CONDENS	SER:				WATER		CONDENS					R-123	
	ION MODE	1.:	EQ-2H	i	REFRIGE	RANT:				R-123		REFRIGE	HANT:					010 / THE
		·			STATUS:					NEM M\ T	OAD LIMIT	STATUS:					NEW W/ D	OAD LIMIT
EAK DE			144.2 350798	KW KWHYR	CONFIGU	DATION				PARALLEL		CONFIGU	RATION:				PARALLEL	
ONSUM	PTION:		350/96	KWHVIN	MAX LEAD		PRO-RA	TE LOAD	o:	80	% j	MIN LAG		ī:			NA	%
EMAND	cost:		\$22,005	ΛΑΚ	LOADLIM	IIT:				92	* !	LOAD LIM	IT:				92	%
NERGY	COST:		\$8,419	/YR							TONS	RATED C	PACITY				119.0	TONS
TOTAL C	OST:		\$30,424	/YR	RATED C					119.0 81.9	KW	RATED PO					91.9	KW
NUT OU	TPUT COS	τ.	\$139	/TON"YR	RATED P		r:			0.688	KW/TON	RATED E		Y:			0.688	KW/TON
									POWER	ANNUAL	ANNUAL I	CHIL	*	*	*	POWER	ANNUAL	ANNUAL
٧.	PLANT	PLANT	ANNUAL OCCUR	PLANT	LOAD	% RAT	% BAT	% BAT	POWER	OCCUR	ENERGY	LOAD	RAT	RAT	TAR		OCCUR	ENERGY
PLANT	LOAD	LOAD	ACTUAL	DEMAND	LOAD	CAP	CAP	POW		ADJUST	CONSUMP		CAP	CAP	POW		ADJUST	CONSUM
SGN		SHED	ACTUAL			ACT	ADJ				i		ACT	ADJ				
OAD										HBYR	KWHYB	TONS	%	*	%	ĸw	HRYR	KWHYR
ж.	TONS	TONS	HRYR	KW	TONS	<u> </u>	*	*	_ KW		- MINTE	1045						
0 V	v 0.1	0.0	4380	0.0	0.0	0	0	0	0.0	0	0 1	0.0	0	0	0	0.0	0	
3 5	5 7.	0.0	37	21.3	7.1	6	15	26	21.3	15 50	320 1085	0.0	Ň	ň		0.0	ŏ	
8 5	5 19.6		50	21.3	19.0	16	16	26	21.3	50 85	1385	0.0	ŏ	ă	0	0.0	ŏ	
13 8			65	21.3	30.9	26	26 36	26 30	21.3 24.6	83	2042	0.0	ŏ	ŏ	ŏ	0.0	ŏ	
18 5			83	24.6	42.8	36 48	46	30	31.1	108	3297 1	0.0	õ	ŏ	ō	0.0	ō	
23 9			106	31.1	54.7	45 56	56	47	38.5	143	5508	0.0	ŏ	ō	0	0.0	0	
28 5			143	38.5	66.6	66	88	57	46.7	184	8593	0.0	ŏ	ò	0	0.0	0	
33 5			184	46.7 55.7	78.5	78	76	68	55.7	232	12922	0.0	ō	0	0	0.0	0	
38 5			232	59.0	51.2	43	43	36	29.5	259	7641	51.1	43	43	36	29.5	259	78-
43 5			259 292	65.6	57.1	48	48	40	32.8	292	9578	57.1	48	48	40	32.8	292	95
48 5			343	72.0	63.1	53	53	44	36.0	343	12348	63.0	53	53	44	36.0	343	123
53 5			381	80.2	69.0	58	58	49	40.1	381	15278	69.0	58	58	49	40.1	381	152
58 S			388	88.4	75.0	63	63	54	44.2	388	17150	74.9	63	63	54	44.2	388	171
68			374	98.8	80.9	68	58	59	48.3	374	18064	80.9	68	58	59	48.3	374	180
73		-	357	104.8	86.9	73	73	64	52.4	357	18707	86.8	73	73	64	52.4	357	187
78			308	114.6	92.8	78	78	70	57.3	308	17648	92.8	78	78	70	57.3	308 247	176 153
	S 197.		247	124.4	98.8	83	83	76	62.2	247	15363	98.7	83	83	76	62.2 67.2	171	114
	S 209.		171	134.4	104.7	88	88	82	67.2	171	11491	104.7	88	88 92	82	72.1	109	78
	5 221.		109	144.2	109.5	92	92	88	72.1	109	7859	109.5	92 92	92	88	72.1	59	42
	5 233		59	144.2	109.5	92	92	88	72.1	59	4254	109.5	92	92	88	72.1	25	18
	S 245		25	144.2	109.5	92	92	88	72.1	25	1803 505	109.5	92	92	88	72.1	7	5
	\$ 257	38.0	7	144.2	109.5	92	92	88	72.1	7 2	505 144	109.5 109.5	92	92	88	72.1	2	1
	S 268		2		1 109.5	92 92	92 92	88	72.1 72.1	0	144	109.5	92	92	88	72.1	ō	
118	S 280	61.8			1 109.5	92	*2	••	72.1		i						3322	1578
			8802		1					4200	192983						-	.076

PLANT I				13	!	MASTER	HILLER N	O (LEAD):		20	
BULDIN				14020	!						CENT	
DESIGN	ILC	DAD:		154	TONS	COMPRES					WATER	
WINTER	l L	DAD:		0	%DSGN	CONDENS					R-123	
SIMULA	TIC	W MODEL:		EQ-1		REFRIGER	RANT:					CAD LIMIT
PEAK D	-	AND		86.9	KW I	SIATUS.						
CONSU				218071	KWHYR	CONFIGU					SINGLE	
						MAX LEAD	SETPT o	r PRO-R/	ATE LOAD) .	NA.	%
DEMAN	D C	OST:		\$13,261	/YR	LOAD LIM	IT:				91	%
ENERG	Y C	OST:		\$5,234	YR							
TOTAL				\$18,495	AL I	RATED CA					154.0	TONS
					1	RATED PO					101.0	KW
UNIT O	ŲTF	OT COST:		\$132	/TON"YR	RATED EF	FICIENC	/ :			0.656	KW/TON
~~~ -	_	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
PLANT		LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
DSGN			SHED	ACTUAL	i		CAP	CAP	POW		ADJUST	CONSUMP
LOAD					į		ACT	ADJ				
%		TONS	TONS	HRYR	KW .	TONS	%	%	%	KW	HR/YR	KWHYR
<del></del>	w	0.0	0.0	4380	0.0	0.0		0		0.0	0	
3	s	4.8	0.0	37	26.3	4.6	3	15	26	26.3	7	18-
8	s	12.3	0.0	50	26.3	12.3	8	15	26	26.3	27	71
13	s	20.0	0.0	65	26.3		13	15	26	26.3	58	147
18	s	27.7	0.0	83	28.3	27.7	18	18	26	26.3	83	218
23	s	35.4	0.0	106	26.3	35.4	23	23	26	26.3	106	278
28	s	43.1	0.0	143	26.3	43.1	28	28	26	26.3	143	378
33	s	50.8	0.0	184	28.3	50.8	33	33	28	28.3	184	520
38	s	58.5	0.0	232	32.3	58.5	38	38	32	32.3	232	749
43	s	68.2	0.0	259	36.4	66.2	43	43	36	38.4	259	942
48	s	73.9	0.0	292	40.4	73.9	48	48	40	40.4	292	1179
53	s	81.6	0.0	343	44.4	\$1.6	53	53	44	44.4	343	1522
58	s	89.3	0.0	381	49.5	\$9.3	58	58	49	49.5	381	1886
63	s	97.0	0.0	388	54.5	97.0	63	63	54	54.5	388	2114
68	s	104.7	0.0	374	59.6	104.7	68	68	59	59.6	374	2229
73	s	112.4	0.0	357	64.6	112.4	73	73	64	64.6	357	2308
78	s	120.1	0.0	308	70.7	120.1	78	78	70	70.7	308	2177
83	s	127.8	0.0	247	76.8	127.8	83	83	76	76.8	247	1897
88	S	135.5	0.0	171	82.8	135.5	88	88	62	82.8	171	1415
93	S	143.2	3.1	109	86.9	140.1	91	91	86	86.9	109	947
98	S	150.9	10.8	59	86.9	140.1	91	91	86	86.9	59	512 217
103	s	158.5	18.5	25	88.9	140.1	91	91	96	86.9	25	217
108	s	168.3	28.2	7	86.9	140.1	91	91	86	86.9	7	
113	s	174.0	33.9	2	86.9	140.1	91	91	86	86.9	2	17
118	5	181.7	41.6	0	86.9	140.1	91	91	86	86.9		
				8602							4160	21807

Table I-3. ECO-1 Calculation of Revised Chiller Energy Cost with Load Limits

PLANT NO			14		MASTER	CHILLER	NO (LEA	0):		21	
BUILDING DESIGN L			14023	TONS	I COMPRE	ccor.				-	
WINTER L			166	%DSGN	COMPRE					CENT	
	ON MODEL:		EQ-1	ALCO (81)	REFRIGE					WATER R-123	
					STATUS:						LOAD LIMIT
PEAK DEA			90.4	KW							Jinii
CONSUME	TION:		237087	KWHYR	CONFIGU					SINGLE	
DÉMAND	COST:		*** 705	A/B		D SETPT	or PRO-R	ATELOA	D:	NA	%
ENERGY (			\$13,795 \$5,690	AVR . (	LOADLIN	u I:				88	%
TOTAL CO			\$19,485	AN I	RATED	APACITY:				166.0	TONS
			4.4,400		RATED P					110.2	KW
UNIT OUT	PUT COST:		\$133	/TONTYR		FFICIENC	Y:			0.684	KW/TON
	PLANT		ANIS****	DI 4117	0115						
% PLANT	LOAD	PLANT	ANNUAL OCCUR	PLANT.   DEMAND	LOAD	% BAT	% RAT	% BAT	POWER	ANNUAL	ANNUAL
DSGN	FOND	SHED	ACTUAL	DEMANU	LOAD	CAP	CAP	RAT POW		ADJUST	ENERGY
LOAD			7.0 1 OFG.	i		ACT	ADJ	FOW		YM021	CONSUMP
	TONS	20115	LIBA -								
<u>*                                    </u>	10NS	TONS	HR/YR	_ KW	î DNS	<b>%</b>	<b>%</b>	_ %	KW	HR/YR	KWHYR
0 W	0.0	0.0	4380	0.0	0.0	0	0	0	0.0	0	
3 5	5.0	0.0	37	28.7	5.0	3	15	26	28.7	7	20
8 S	13.3	0.0	50	28.7	13.3	8	15	26	28.7	27	77!
13 S	21.6	0.0	85	28.7	21.6	13	15	26	28.7	56	160
18 S 23 S	29.9	0.0	83	28.7	29.9	18	18	26	28.7	83	238
23 S 28 S	38.2	0.0	106	28.7	38.2	23	23	26	28.7	106	304
28 S	46.5 54.8	0.0	143	28.7	46.5	28	28	26	28.7	143	4104
33 S	63,1	0.0	184 232	30.9   35.3	54.8	33	33	28	30.9	184	5686
43 S	71.4	0.0	232 259	35.3	63.1 71.4	38 43		32	35.3	232	8190
43 S	79.7	0.0	259 292	39.7   44.1	71.4	43 48	43 48	36 40	39.7	259	10282
53 S	88.0	0.0	343	48.5	88.0	48 53	53	40	44.1 48.5	292 343	12877
58 S	96.3	0.0	381	54.0	96.3	58	58	44	48.5 54.0	343	16636 20574
63 S	104.6	0.0	388	59.5	104.6	63	63	54	59.5	388	23086
68 S	112.9	0.0	374	65.0	112.9	68	68	59	65.0	374	
73 S	121.2	0.0	357	70.5	121.2	73	73	64	70.5	357	24310 25169
78 S	129.5	0.0	308	77.1	129.5	78	78	70	77.1	308	23747
83 S	137.8	0.0	247	83.8	137.8	83	83	76	83.8	247	20699
88 S	146.1	0.0	171	90.4	146.1	88	88	82	90.4	171	15458
93 S	154,4	8.3	109	90.4	146.1	88	88	82	90.4	109	9854
98 S	162.7	16.6	59	90.4	146.1	88	88	82	90.4	59	5334
103 S	171.0	24.9	25	90.4	146.1	88	88	82	90.4	25	2260
108 S	179.3	33.2	7	90.4	146.1	88	88	82	90.4	7	633
113 S	187.8	41.5	2	90.4	146.1	88	88	92	90.4	2	181
118 \$	195.9	49.8	0	90.4	146.1	88	88	82	90.4	0	(
			8802	1						4180	22700
			\$602 15 21002		MASTER	CHILLER	NO (LEAD			4180	237087
PLANT NO BUILDING DESIGN LO WINTER LO SIMULATION	NO: OAD;			TONS	MASTER COMPRES	SSOR: SER:					23709
BUILDING DESIGN LO WINTER LO SIMULATIO	NO: OAD: OAD: ON MODEL:		15 21002 240 0 EQ-1	%DSGN	COMPRES	SSOR: SER:				22 CENT WATER R-123	237087
BUILDING DESIGN LO WINTER LO SIMULATION PEAK DEW	NO: OAD: OAD: ON MODEL: MND:		15 21002 240 0		COMPRES CONDENS REFRIGE	SSOR: SER: RANT:				22 CENT WATER R-123	-
BUILDING DESIGN LO WINTER LO SIMULATION PEAK DEM CONSUMP	NO: DAD: OAD: ON MODEL: MND: TION:		15 21002 240 0 EQ-1 144.0 365360	*DSGN   KW   KWHYR	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAR	SSOR: SER: RANT: RATION: SETPT o				CENT WATER R-123 NEW W/ I	-
BUILDING DESIGN LO WINTER LO SIMULATION PEAK DEM CONSUMP	NO: OAD: OAD: ON MODEL: MAND: TION:		15 21002 240 0 EQ-1 144.0 365360 \$21,974	%DSGN   	COMPRES CONDENS REFRIGE STATUS:	SSOR: SER: RANT: RATION: SETPT o			 	22 CENT WATER R-123 NEW W/ I	CAD LIMIT
BUILDING DESIGN LO WINTER LO SIMULATION PEAK DEM CONSUMP DEMAND CO BNERGY CO	NO: OAD: OAD: ON MODEL: VAND: VTION: COST: COST:		15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769	%DSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAR LOAD LIM	SSOR: SER: RANT: RATION: DISETPT 6				CENT WATER R-123 NEW W/ I SINGLE NA	CAD LIMIT
BUILDING DESIGN LO WINTER LO SIMULATION PEAK DEM CONSUMP DEMAND CO BNERGY CO	NO: OAD: OAD: ON MODEL: VAND: VTION: COST: COST:		15 21002 240 0 EQ-1 144.0 365360 \$21,974	%DSGN   	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAR LOAD LIM	SSOR: SER: RANT: RATION: D SETPT 6 IT:			 	CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0	CAD LIMIT % % TONS
BUILDING DESIGN LO WINTER LO SIMULATIO PEAK DEV CONSUMP DEMAND O BNERGY O TOTAL CO	NO: DAD: DAD: DAN MODEL: HAND: ITION: DOST: SST:		15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743	%DSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAF LOAD LIM RATED C. RATED PO	SSOR: SER: RANT: RATION: D SETPT of IT: APACITY: DWER:	e PRO-R			22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4	COAD LIMIT % % TONS KW
BUILDING DESIGN LE WINTER LE SIMULATIO PEAK DEM CONSUMP DEMAND CE BNERGY CO TOTAL CO UNIT OUTF	NO: DAD: DAD: DAD: DAN MODEL: LAND: TION: DOST:		15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769 \$30,743	*LDSGN   KW   KWHYR   //R   //R   //R   //TONTYR	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAR LOAD LIM RATED CR RATED ER	SSOR: SER: RANT: RATION: D SETPT of IT: APACITY: DWER:	e PRO-R		>:	CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0	CAD LIMIT % % TONS
BUIL DING DESIGN LO WINTER LO SIMULATION PEAK DEM CONSUMP DEMAND O BNERGY O TOTAL CO UNIT OUTF	NO: DAD: DAD: DAD: DAN MODEL:  AND: TION: COST: COST: ST: PUT COST:	PLANT	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142	*DSGN    KW    KWHYR    //R    //R    //TONTYR    PLANT	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LIM RATED C. RATED PO RATED ET CHIL	SSOR: SER: RANT;  RATION: D SETPT 6 IT:  APACITY: DWER: FFICIENCY	r PRO-R	ATE LOAD	D:	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708	COAD LIMIT % % TONS KW KW/TON
BUILDING DESIGN L WINTER L SIMULATIO PEAK DEM CONSUMP DEMAND C POTAL CO UNIT OUTF	NO: DAD: DAD: DAD: DAN MODEL: LAND: TION: DOST:	LOAD	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR	*LDSGN   KW   KWHYR   //R   //R   //R   //TONTYR	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAR LOAD LIM RATED CR RATED ER	SSOR: SER: RANT; RATION: O SETPT of IT: APACITY: DWER: FFICIENCY	Y PRO-R	ATE LOA!		22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708 ANNUAL OCCUR	OAD LIMIT  TONS KW KW/TON ANNUAL ENERGY
BUILDING DESIGN LI WINTER LI SIMULATIC SIMULATIC PEAK DEA CONSUMP DEMAND CENERGY C TOTAL CO UNIT OUTT	NO: DAD: DAD: DAD: DAN MODEL:  AND: TION: COST: COST: ST: PUT COST:		15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142	*DSGN    KW    KWHYR    //R    //R    //TONTYR    PLANT	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LIM RATED C. RATED PO RATED ET CHIL	SSOR: SER: RANT: PATION: SETPT of SETPT of SETPT of SETPT of SET! SET! SET! SET! SET! SET! SET! SET!	Y PRO-R	ATE LOAD		22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708	COAD LIMIT % % TONS KW KW/TON
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BUILDING DESIGN L  DESIGN L  DESIGN L  DESIGN L  PEAK DEV  CONSUMP  DEMAND C  DEMAND C  DEMAND C  OTOTAL CO  UNIT OUTF  X  PLANT  DSGN  LOAD	NO: DAD: DAD: DAD: DAN MODEL:  AND: TION: COST: COST: ST: PUT COST:	LOAD	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR	*DSGN    KW    KWHYR    //R    //R    //TONTYR    PLANT	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LIM RATED C. RATED PO RATED ET CHIL	SSOR: SER: RANT: PATION: SETPT of SETPT of SETPT of SETPT of SET! SET! SET! SET! SET! SET! SET! SET!	Y PRO-R	ATE LOA!		22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708 ANNUAL OCCUR	OAD LIMIT  TONS KW KW/TON ANNUAL ENERGY
BUILDING DESIGN LI WINTER LI SIMULATIO PEAK DEV CONSUMP DEMAND ( ENERGY C TOTAL CO UNIT OUTF PLANT DOSGN LOAD	NO: OAD: OAD: OAD: OAD: OAD: OAD: OAD: OA	TONS	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR	*LDSGN    KW KWHYR    KR KWHYR    KR KW KW KWHYR    KW KW KW KW KW KW KW KW KW KW KW KW KW K	COMPRESCONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED C: RATED P: RATED E: CHL LOAD TONS 0.0	SSOR: SER: RATION: O SETPT of IT: APACITY: DWER: FICIENCY RAT CAP ACT	Y: YRO-R/	% RAT POW	POWER	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 ANNUAL OCCUP ADJUST	ANNUAL ENERGY CONSUMP
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BULDING DESIGN LOWNTER L. SIMULATIO PEAK DENCONSUMP PEAK DENCONSUMP OF TOTAL CO UNIT OUTF X PLANT DSGN LOAD  0 W 3 SS 6 S 13 S 18 S 18 S	NO: DOAD: DO	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 66 83	*LDSGN   KW   KWHYR   YR   YR   YR   YR   YR   YR   TON'YR   DEMAND   KW   1   44.0   44.0   44.0   44.0   44.0	COMPRESCONDENS REFRIGE STATUS: CONFIGURA MAX LEAR LOAD LM RATED C, RATED PR RATED E CHL LOAD  TONS  0.0 0.2 19.2 31.2 43.2	SSOR: SER: RANT:  RATION: D SETPT of IT:  APACITY: DWER: FFICIENCY  RAT CAP ACT  0 3 8 13 18	% PRO-R/ % RAT CAP ADJ % 0 15 15 15 15 18	% 0 26 26 26 26 26 26	POWER  0.0 44.0 44.0 44.0 44.0	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 109.4 0.708 ANNUAL OCCUPA ADJUST HR/YR	ANNUAL ENERGY KWH/YR  CONSUMP KWH/YR  1188 2464 3652
BULDING DESIGN LA WINTER L SIMULATIC PEAK DBA CONSUMP DEMAND C ENERGY C TOTAL CO UNIT OUTF A PLANT DSGN LOAD  W 3 S 6 S 13 S 18 S 23 S 23 S	NO: DAD: DAD DAD DAD DAD DAD DAD DAD DAD D	TONS 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 65 83 108	*LDSGN   KW   KWH-YR   YR   YR   YR   YR   TON'YR   DBMAND	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED E RATED E TONS  0.0 7.2 19.2 31.2 43.2 55.5.2	SSOR: SER: RANT: BATION: DISETPT of IT: APACITY: DWER: FFICIENCY ACT O 3 B B 13 18 23	% PRO-R/ % RAT CAP ADJ % 15 15 15 18	% RAT POW % 0 26 26 26 26 26 26 26	POWER  0.0 44.0 44.0 44.0 44.0 44.0	22 CENT WATER R-123 NEW W/ 1 SINCLE NA 90 240.0 169.4 0.708 ANNUAL OCCUR ADJUST HR/YR 0 7 27 58 83 108	CAD LIMIT  TONS KW KW/TON  ANNUAL ENERGY CONSUMP  KWH/YR  306 1188 2464 3852 4864
BUILDING DESIGN LOWNTER LI SIMULATION PEAK DEMOCONSUMP DEMAND CONSUMP TOTAL CO UNIT OUTT  VA PLANT DOSAN UNIT OUTT  VA 0 W 3 S 8 S 13 S 18 S 18 S 23 S	NO: DOAD: DO	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 65 83 108	%DSGN   KW   KWHYR   KWHYR   YR   YR   YR   YR   YR   TON'YR   DEMAND   KW   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0   44.0	COMPRESCONDENS REFRIGES TATUS: CONFIGURA MAX LEAF LOAD LM RATED C, RATED PRATED E  CHL LOAD  TONS  0.0 7.2 19.2 31.2 43.2 55.2 67.2	SSOR: SER: RANT: RATION: SETPT of IT: APACITY: DWER: FFICIENCY  **  **  **  **  **  **  **  **  **	% PRO-P. % RAT CAP ADJ % 15 15 18 23 28	% RATE LOAD	POWER  0.0 44.0 44.0 44.0 44.0 44.0 44.0	22 CENT WATER R-123 NEW W/ I SINCLE RA 90 240.0 169.4 0.708 ANNUAL OCCUR ADJUST HRAYR 6 83 106 143	CAD LIHIT  %  TONS  KW  KW/TON  ANNUAL  ENERGY  CONSUMP  KWH/YR  0  308  1188 2464 3852 4864 6292
BUILDING DESIGN LUSIMULATIC WINTER L WINTER L WINTER L WINTER L CONSUMP DEMAND C ENERGY C TOTAL CO UNIT OUTF L A DSGN LOAD  W 3 S 6 S 13 S 18 S 23 S 23 S	NO: DOAD: OAD: OAD: OAD: OAD: OAD: OAD: O	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 385380 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 65 83 108 143	*LDSGN   KW   KWH-YR   YR   YR   YR   YR   YR   TON'YR   DEMAND	COMPRESCONDENS CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED E: CHL LOAD TONS  0.0 7.2 19.2 231.2 43.2 55.2 67.2 79.2	RATION: DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DIS	% PRO-R. % RAT CAP ADJ % 15 15 15 18 29 28 39	% HAT POW % 0 26 26 26 26 26 26 28	POWER  0.0 44.0 44.0 44.0 44.0 44.0 44.0 44.	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.706 ANNUAL OCCUP ADJUST HR/YR 0 7 27 56 83 108 143	CAD LIMIT  TONS KW KW/TON  ANNUAL ENERGY CONSUMP  KWH/YR  0 308 11888 2464 3852 4664 6292 8722
BULLDING DESIGN LL WINTER L SIMULATIC WINTER L SIMULATIC PEAK DBM CONSUMP DEMAND O BNERGY C TOTAL CO UNIT OUTF  V PLANT DSGN LOAD  0 W 3 S 8 S 18 S 18 S 18 S 23 S 23 S 33 S	NO: DOAD: OAD: OAD: OAD: OAD: OAD: OAD: O	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVYR 4380 37 50 65 83 106 143 184 232	%DSGN   KW KWHYR   WR KWHYR   WR   WR   WR   WR   WR   WR   WR	COMPRESCONDENS REFRIGES TATUS: STATUS: CONFIGU MAX LEAR LOAD LM RATED PRATED PR	SSOR: SER: RATION: D SETPT of IT: APACITY: DWER: FFICIENCY  RAT CAP ACT  0 3 8 13 18 23 33	% PRO-R. % ADJ % 0 15 15 15 18 28 33 38 38	% RAT POW % 0 26 26 26 26 26 26 26 33 32	POWER  0.0 44.0 44.0 44.0 44.0 44.0 45.4 54.2	22 CENT WATER R-123 INSW W/ I FA 90 240.0 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 56 83 104 143 184 232	CAD LIHIT  %  TONS  KW  KW/TON  ANNUAL  EMERGY  CONSUMP  KWH/YR  (305  1186 244 484 6292 8722 12574
BUILDING DESIGN LIVE WINTER L SIMULATIC WINTER L SIMULATIC PEAK DBJ CONSUMP DEMAND O ENERGY O TOTAL CO UNIT OUTF  LOAD  O W 3 S 8 S 18 S 28 S 28 S 28 S 39 S 39 S 34 S 44 S 44 S	NO: DOAD: OAD: OAD: OAD: OAD: OAD: OAD: O	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 385380 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 65 83 108 143	*LDSGN   KW   KWH-YR   YR   YR   YR   YR   YR   TON'YR   DEMAND	COMPRESCONDENS REFRIGE STATUS: CONFIGURA MAX LEAR LOAD LIM RATED C. RATED PR. RATED ET CHL. LOAD  TONS  10.0 7.2 19.2 19.2 25.2 67.2 79.2 91.2 103.2	RATION: DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DISETPT of DIS	% PRO-R. % RAT CAP ADJ % 15 15 15 18 29 28 39	% RAT POW % 26 26 26 26 26 28 32 2 36	0.0 44.0 44.0 44.0 44.0 44.0 47.4 54.2 81.0	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708 ANNUAL OCCUP ADJUST HR/YR 0 7 27 58 83 106 143 184 232 2550	CAD LIMIT  %  KW KW/TON  ANNUAL ENERGY CONSUMP  KWH/YR  0 308 1188 2464 3652 4864 6292 8722 12574
BULDING DESIGN LL WINTER L WIN	NO: DOAD: DO	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 63 106 143 184 232 259	%DSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD L MATED C, RATED P, RATED EI LOAD TONS  0.0 7.2 19.2 31.2 67.2 79.2 91.2 103.2 115.2	RATION: DISETPT of SETPT of SET	/: % RAT CAP % 0 15 15 15 18 23 39 38 43	% 0 26 26 26 26 28 32 36 40	POWER  0.0 44.0 44.0 44.0 44.0 44.0 45.2 61.0 67.8	22 CENT WATER R-123 INEW W/ I FINAL PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY IN THE PROPERTY I	CAD LIHIT  %  TONS  KW  KW/TON  ANNUL  ENERGY  CONSUMP  KWHYR  0  308  1188 2484 2484 2482 2487 2574 15799
BUILDING DESIGN LIVE WINTER L SIMULATIC PEAK DEA CONSUMP DEMAND ( ENERGY C TOTAL CO UNIT OUTF  V  O W  3 S 8 S 13 S 18 S 28 S 28 S 38 S 18 S 28 S 38 S 49 S 49 S 55 S 55 S 55 S	NO: DAD: DAD DAD: DAD DAD: DAD DAD: DAD DAD	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 385960 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVR 4380 65 83 106 83 108 1143 1143 1144 222 259 202	%DSGN   KW   KWHYR   KWHYR   YR   YR   YR   YR   YR   YR   YR	COMPRESCONDENS REFRIGE STATUS: CONFIGURA MAX LEAR LOAD LIM RATED C. RATED PR. RATED ET CHL. LOAD  TONS  0.0 7.2 19.2 19.2 25.2 67.2 79.2 91.2 103.2	SSOR: SER: RANT: RATION: D SETPT of SETPT of SETPT of SERIOR WER: FFICIENCY  AAT CAP ACT ACT ACT ACT 3 8 13 18 23 28 33 38 48	% PRO-R. % ADJ 15 15 16 18 23 28 23 38 443	% RAT POW % 26 26 26 26 26 28 32 2 36	0.0 44.0 44.0 44.0 44.0 47.4 54.2 61.0 67.8 74.5	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.706 ANNUAL OCCUPR ADJUST HRAYR 0 7 7 58 83 106 143 232 259 292 343	CAD LINIT  %  XW  KWTON  ANNUAL  ENERGY  CONSUMP  KWH/YR  0  308 1188 2464 3852 4864 6292 8722 12574 15799 19708
BULLDING DESIGN LL WINTER L WINTER L SIMULATIC PEAK DEM CONSUMP DEMAND G BIERGY C TOTAL CO UNIT OUTF  V PANT DSGN LOAD  0 W 3 S 4 S 13 S 13 S 13 S 13 S 14 S 23 S 23 S 23 S 24 S 35 S 35 S 36 S 56 S 56 S 56 S	NO: DOAD: DO	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 108 143 184 232 259 292 292	%DSGN   KW   KWHYR   KWHYR   YR   YR   YR   YR   YR   YR   YR	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED E. TONS 0.0 7.2 19.2 31.2 43.2 55.2 67.2 79.2 2103.2 113.2 113.2 127.2 131.2	SSOR: SER: RATION: SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETPT discussion SETP	% PRO-R. % RAT CAP 15 15 15 15 18 23 33 34 43 443 55 55	% RATE LOAD % RATE LOAD % RATE POW % 0 26 26 26 26 26 28 32 26 40 44 45 45	POWER  0.0 44.0 44.0 44.0 44.0 44.0 45.2 61.0 67.8 74.5 83.0	22 CENT WATER R-123 INEW W/ I PO PO PO PO PO PO PO PO PO PO PO PO PO	CAD LIHIT  **  **  **  **  **  **  **  **  **
BUILDING DESIGN LIVE WINTER L SIMULATIC PEAK DEA CONSUMP DEMAND ( BNERGY C TOTAL CO UNIT OUTF  V A  0 W 3 S 8 S 13 S 18 S 23 S 24 S 23 S 24 S 33 S 44 S 55 S 55 S 55 S 65 S 65 S 65 S	NO: DAD: DAD DAD: DAD DAD: DAD DAD: DAD DAD	TONS	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 65 83 106 143 184 2392 2599 2692 343 381 388 374	*LDSGN	COMPRESCONDENS REFRIGE STATUS: CONFIGURA MAX LEAR LOAD LM RATED CRATED PRATED ET CHL LOAD  TONS  0.0 0.0 1.2 19.2 31.2 43.2 55.2 67.2 79.2 91.2 115.2 115.2	SSOR: SERTANT: RATION: SETPT of IT: PARCITY: PARCITY: WHER: ACT  ACT  0 3 8 13 11 18 23 33 34 48 53 55	% PRO-R. % RAT CAP ADJ 15 15 15 15 12 28 33 38 43 44 65 55 56	% RAT POW % 0 266 266 266 26 26 32 36 40 44 44	0.0 44.0 44.0 44.0 44.0 47.4 54.2 61.0 67.8 74.5	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.706 ANNUAL OCCUPR ADJUST HRAYR 0 7 7 58 83 106 143 232 259 292 343	CAD LIHIT  %  Y  KW  KW/TON  ANNUAL  ENERGY  CONSUMP  KWH/YR  (  38552  4864  6292  62722  15764  15766  1182  25553
BULLDING DESIGN LL WINTER L SIMULATIC PEAK DEM CONSUMP DEMAND G BIERGY C TOTAL CO UNIT OUTF  % PLANT DSGN LOAD  0 W 3 S 8 S 13 S 13 S 13 S 13 S 14 S 13 S 14 S 15 S 15 S 15 S 15 S 15 S 15 S 15 S 15	NO: DOAD: DO	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 65 83 108 144 222 259 292 292 292 293 381 388 374 357	*LDSGN   KW   KWHYR   KWHYR   YR   YR   YR   YR   YR   YR   YR	COMPRES CONDENS REFRIGES STATUS: CONFIGU MAX LEAI LOAD LM  RATED C, RATED PI RATED E  10.0 7.2 19.2 31.2 43.2 43.2 55.2 67.2 19.2 103.2 115.2 127.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2 139.2	SSOR: SER: RATION: RATION: SETPT delta PACITY: VOWER: CAP ACT  0 3 8 8 13 18 23 34 48 53 55 63 66 66 67 73	/: % AAT CAP ADJ 15 15 15 18 23 33 34 44 45 50 56 66 66 73 73	% RATE LOAM % 0 26 26 26 26 26 40 44 45 54	POWER  0.0 44.0 44.0 44.0 44.0 45.1 61.0 67.8 67.8 69.1 83.0 91.5	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.708 ANNUAL OCCUPT ADJUST ADJUST 68 31 108 143 222 259 243 381 388 374 357	CAD LIHIT  %  Y  TONS  KW  KW/TON  ANNUAL  ENERGY  CONSUMP  KWH/YR  (0  3085  1188  2484  2484  2487  15799  119798  2555  31822  35500  37383  38809
BUILDING DESIGN LIVE WINTER L SIMULATIC PEAK DEA CONSUMP DEMAND ( ENERGY C TOTAL CO UNIT OUTF  PLANT DSGN L OAD  0 W 3 S 8 S 13 S 8 S 13 S 23 S 24 S 23 S 34 S 35 S 36 S 37 S 78 S 78 S	NO: DAD: DAD DAD: DAD DAD: DAD DAD: DAD DAD	TONS - 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 385360 \$21,974 \$3,769 \$30,743 \$1142 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 65 83 106 143 184 222 259 243 381 388 374 357 308	*LDSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED E  CHL LOAD  TONS  0.0 7.2 19.2 31.2 43.2 55.2 67.2 79.2 103.2 215.2 115.2 127.2 139.2 131.2 163.2 163.2 175.2 175.2 175.2 175.2 175.2 175.2	SSOR: SERT: RATION: SETTIC PACITY: PACITY: WHER: CAP ACT  0 0 3 8 13 18 23 28 33 34 48 53 35 66 67 78	% PRO-R. % ALJ CAP 0 0 15 15 15 16 23 28 8 42 48 53 66 67 76 66 67 76	% RATE LOA! % RATE POW 0 26 26 26 26 26 26 40 44 45 59 64 47 70	POWER  KW  0.0 44.0 44.0 44.0 44.0 44.0 67.9 74.5 83.0 91.5 99.9 108.4 118.8	22 CENT WATER R-123 IN INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/ INC. W/	CAD LIHIT  %  TONS  KW  KWITON  ANNUAL  ENERGY  CONSUMP  KWHYR  ( 308  1188  2464  3852  4584  6292  12574  15795  31822  35502  37383  38899  36522
BULLDING DESIGN LL WINTER L SIMULATIC PEAK DEM CONSUMP DEMAND G ENERGY C TOTAL CO UNIT OUTT	NO: DOAD: DO	TONS	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVYR 4380 37 50 65 83 106 143 184 222 259 292 243 381 381 381 388 374 357 308 247	%DSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM  RATED C, RATED PI RATED E  10.0 1.2 19.2 31.2 19.2 103.2 115.2 127.2 139.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2 175.2	SSOR: SERTATON: RATION: SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT do SETPT	f: % RAT CAP ADJ % 0 15 15 15 18 23 33 33 34 44 45 50 56 66 73 76 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 63 68 68 68 68 68 68 68 68 68 68 68 68 68	% NATE LOAI % RAT POW % 0 26 26 26 26 26 28 32 36 40 44 49 34 59 64 70 66 47 76 66 47 76 76 66 76 76 76 76 76 76 76 76 76 76	POWER  NW  0.0 44.0 44.0 44.0 44.0 47.4 54.2 61.0 67.8 83.0 91.5 99.9 108.4 118.8 128.7	22 CENT WATER R-123 NEW W/ I SINGLE RA 90 240.0 169.4 0.708 ANNUAL OCCUR ADJUST HRAYR 164 232 259 243 381 848 374 357 308 247 308	CAD LIMIT  %  TONS  KW  KW/TON  ANNUAL  ENERGY  CONSUMP  KWH/YR  (0  300  1181  246- 38555; 4864  6292  872: 12577  19799  19799  3182: 35500  37368  38800  3862: 31786
BUILDING DESIGN LIVE WINTER L SIMULATIC PEAK DBJ CONSUMP DEMAND ( BNERGY C TOTAL CO UNIT OUTF PLANT DCAN 0 W 3 S 8 S 13 S 18 S 23 S 28 S 38 S 49 S 39 S 38 S 49 S 39 S 38 S 49 S 39 S 38 S 49 S 39 S 38 S 49 S 39 S 38 S 39 S 39 S 39 S 39 S 39 S 39 S 39 S 39	NO: DAD: DAD DAD: DAD DAD: DAD DAD: DAD DAD	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$8,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRYR 4380 37 50 65 83 106 143 232 259 262 343 381 388 374 357 374 367 374 367 374 367 374 367 374 374 367 374 374 374 374 374 374 374 374 374 37	*LDSGN    KW   KWH-YR    /YR    /YR    /YR    /YR    /YR    /YR    /TON'YR    EDMAND       KW       KW       KW       44.0    44.0    44.0    44.0    44.0    44.0    45.2    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0    51.0	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED E: CHL LOAD TONS  0.0 7.2 19.2 19.2 19.2 115.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2	SSOR: SER: RATION: SETT: APACITY: WER: CAP ACT  ACT  ACT  BAT  CAP  3 8 13 18 53 33 34 48 53 58 68 67 78 83	** PRO-R.  *** ** ** ** ** ** ** ** ** ** ** **	% RATE LOA! % RATE POW % 0 26 26 26 26 26 26 40 44 49 59 59 64 47 70 76 82	POWER  KW  0.0 44.0 44.0 44.0 44.0 44.0 67.8 74.5 83.0 91.5 99.9 108.8 128.7 138.9	22 CENT WATER R-123 NEW W/ I SINCLE NA 90 169.4 0.708 ANNUAL OCCUP ADJUST 106 184 232 250 202 343 381 389 374 357 308 247 171	CAD LIHIT  %  TONS  KW  KWITON  ANNUAL  ENERGY  CONSUMP  KWHYR  ( 308  1188  2464  3852  3852  12574  15798  31822  35502  37383  38899  38622  37383  38899  38622  37383  38899  38622  37383
BUILDING DESIGN LIVE WINTER LISTMULATIC WINTER LISTMULATIC PEAK DEW CONSUMP DEMAND OF BIERGY CONSUMP DEMAND OF BIERGY CONSUMP LOAD  W O O W O O O O O O O O O O O O O O O	NO: DOAD: OAD: OAD: OAD: OAD: OAD: OAD: O	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 EQ-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HRVYR 4380 37 50 65 83 106 143 184 222 259 292 343 381 381 387 374 357 308 374	*LDSGN	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM  RATED C, RATED P, RATED E  TONS  0.0 7.2 19.2 31.2 43.2 55.2 27.2 103.2 115.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 139.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2 127.2	SSOR: SER: RATION: SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta SETPT delta	f: % RAT CAP ADJ 15 15 15 15 15 15 15 15 15 15 16 23 33 34 44 85 3 15 3 16 86 87 77 78 83 88 89 90	% RATE LOAI % RAT POW % 0 26 26 26 26 28 38 39 44 44 49 59 46 40 76 68 22 85 85 86 86 86 86 86 86 86 86 86 86 86 86 86	POWER  NW  0.0 44.0 44.0 44.0 44.0 44.0 44.0 47.4 54.2 61.0 83.0 91.5 99.9 108.4 118.8 128.7 138.9 144.0	22 CENT WATER R-123 INEW W/ I FAM 90 240.0 ANNUAL OCCUR ADJUST HR/YR 0 7 7 27 56 83 106 143 184 232 259 292 343 381 388 374 357 308 247 171 109	CAD LIHIT  %  TONS  KW  KW/TON  ANNUAL  ENERGY  CONSUMP  KWH/YR  (0  305  1188 244 846 6292 8722 12574 16796 2355 31788 23752 3788 23752 31788 23752
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BUILDING DESIGN LIVE WINTER L SIMULATIC WINTER L SIMULATIC CONSUMP DEMAND ( ENERGY CO UNIT OUTF  X PLANT DOAD  3 S 13 S 13 S 13 S 14 S 23 S 38 S 44 S 53 S 38 S 48 S 53 S 38 S 48 S 53 S 38 S 48 S 53 S 38 S 48 S 53 S 58 S 58 S 58 S 58 S 58 S 58 S 58 S 58	NO: DAD: DAD: DAD: DAD: DAD: DAD: DAD: DA	TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	15 21002 240 0 50-1 144.0 365360 \$21,974 \$3,769 \$30,743 \$142 ANNUAL OCCUR ACTUAL HR/YR 4380 37 50 65 83 106 143 184 232 259 292 292 292 343 381 388 374 357 308 377 109 377 1171 109 59 59	*LDSGN    KW   KWH-YR    YR    YR    YR    YR    YR    YR    TONTYR    EDMAND    LOS    KW    LOS	COMPRES CONDENS REFRIGE STATUS: CONFIGU MAX LEAI LOAD LM RATED P. RATED E. CHL LOAD  TONS  0.0 7.2 19.2 19.2 19.2 19.2 19.2 115.2 127.2 139.2 115.2 127.2 129.2 127.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 129.2 121.2 121.0 1216.0 1216.0 1216.0 1216.0	SSOR: SER: RATION: SETT of APACITY: WER: APACITY:	** PRO-R.  ** RAT CAP**  0 15 15 15 15 15 12 28 33 38 44 48 85 35 86 87 78 88 89 90 90 90 90 90 90 90 90 90 90 90 90 90	% RATE LOAI  % RAT POW  % 0 26 26 26 26 26 26 40 44 49 59 64 40 70 76 82 85 85 85 85 85	POWER  KW  0.0 44.0 44.0 44.0 44.0 44.0 67.8 74.5 83.0 91.5 99.9 108.4 118.8 128.7 138.9 144.0 144.0 144.0	22 CENT WATER R-123 NEW W/ I SINGLE NA 90 240.0 169.4 0.706 ANNUAL OCCUPR ADJUST HRAYR 0 7 7 58 83 106 143 232 259 292 343 381 388 374 357 7711 100 59 25 7 77	CAD LIHIT  X  X  X  X  X  X  X  X  X  X  X  X  X
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Table I-3. ECO-1 Calculation of Revised Chiller Energy Cost with Load Limits

	LO	AD: AD: N MODEL:	, ,	17 28000 238 0 EQ-2M	TONS (	COMPRES CONDENS REFRIGE STATUS:	SSOR: SER:	io (Lead	):		CENT WATER R-123 NEW W/ L	CAD LIMIT	COMPRES CONDENS REFRIGES STATUS:	SOR: ER:	NO (LAG	1):		CENT WATER R-123 NEW W/ I	OAD LINIT
PEAK DI				144.2 350798	KWH/YR	CONFIGU					PARALLEL		CONFIGU					PARALLEI	
DEMANI				\$22,005	∕/R	MAX LEA		r PRO-RA	ATE LOAD	t.	90 92	*	MIN LAG S LOAD LIM		:			1 <b>0.</b> 92	*
TOTAL (				\$8,419 \$30,424	AYR I	RATED C					119.0	TONS	RATED CA					119.0	TONS
UNIT OU	ITPI	UT COST:		\$139	/TON"YR	RATED P		<b>/</b> :			81.9 0.688	KW/TON	RATED EF		Y:			0.688	KW/TON
% PLANT DSGN LOAD		PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT   DEMAND	CHIL	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL   ENERGY   CONSUMP	CHIL LOAD	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
%		TONS	TONS	HR/YR	KW i	TONS	*	%	%	ĸw	HRYR	KWHYR	TONS	%	%	%	KW	HR/YR	KWHYR
0	w	0.0	0.0	4380	0.0	0.0	0	0	0	0.0	0	0	0.0	0	0	0	0.0	0	0
3	s	7.1	0.0	37	21.3	7.1		15	26	21.3	15	320	0.0	0	0	0	0.0	0	0
	s	19.0	0.0	50	21.3	19.0	16	18	26	21.3	50	1065	0.0	0	0	0	0.0	0	0
	S	30.9	0.0	85	21.3	30.9	26	26	26	21.3	65	1385 j 2042 j	0.0	0	0	0	0.0		0
	S	42.8	0.0	83	24.6	42.8	38	36	30	24.6 31.1	83 108	3297	0.0	0		0	0.0	ő	
	S	54.7	0.0	106	31.1	54.7	46 56	46 56	39 47	38.5	143	5506	0.0	Ď	ŏ	ů	0.0	Ď	
	s	66.6 78.5	0.0	143 184	38.5 48.7	66.6 78.5	68	66	57	48.7	184	8593	0.0	ŏ	ă	0	0.0	ŏ	
	s	90.4	0.0	232	55.7	90.4	76	78	68	55.7	232	12922	0.0	õ	ŏ	ō	0.0	Ö	
	S	102.3	0.0	259	59.0	51.2	43	43	36	29.5	259	7641	51.1	43	43	36	29.5	259	764
	s	114.2	0.0	292	65.8	57.1	48	48	40	32.8	292	9578	57.1	48	48	40	32.8	292	957
	s	126.1	0.0	343	72.0	63.1	53	53	44	36.0	343	12348	63.0	53	53	44	36.0	343	1234
	s	138.0	0.0	381	80.2	69.0	58	58	49	40.1	381	15278	69.0	58	58	49	40.1	381	1527
	s	149.9	0.0	388	88.4	75.0	63	63	54	44.2	388	17150	74.9	63	63	54	44.2	388	1715
68	S	161.8	0.0	374	96.6	80.9	68	68	59	48.3	374	18084	80.9	68	68	59	48.3	374	1806
73	s	173.7	0.0	357	104.8	\$6.9	73	73	64	52.4	357	18707	86.8	73	73	64	52.4	357	1870
	s	185.6	0.0	308	114.6	92.8	78	78	70	57.3	308	17648	92.8	78	78	70	57.3 62.2	308 247	1784 1538
	s	197.5	0.0	247	124.4	98.8	83	83	76	62.2	247	15363	98.7 104.7	83 88	83 88	76 82	67.2	171	1536
	s	209.4	0.0	171	134.4	104.7	88	88	82	67.2 72.1	171 109	11491   7859	104.7	92	92	98	72.1	109	785
	S	221.3	2.3	109	144.2	109.5	92 92	92 92	88 88	72.1	59	4254	109.5	92	92	88	72.1	59	425
	s	233.2	14.2	59	144.2	109.5	92	92	88	72.1	25	1803	109.5	92	92	98	72.1	25	180
	s	245.1	26.1	25 7	144.2	109.5	92	92	88	72.1	7	505	109.5	92	92	88	72.1	7	50
	s	257.0 268.9	38.0	2	144.2	109.5	92	92	99	72.1	2	144	109.5	92	92	88	72.1	2	14
113 118		280.8	81.8	0	144.2	109.5	92	92	88	72.1	ō	0	109.5	92	92	88	72.1	ō	
				8602							4200	192963						3322	157833

APPENDIX I

Table I-4. ECO-1 Calculation of Construction Cost																
	GTY G PER AD. CHIL FAC	QTY LABOR ADJUST DIFFIC FACTOR ADJUST FACTOR	LIND	UNIT BARE (TOT) MTL COST	UNIT BARE (TOT) LAB COST	BARE (TOT) EQP COST	MARK UP	LAB EQP COH&P MARK UP	MARK	MTL LAB COST COST ADJUST ADJUST (AUSTIN) (AUSTIN)	COST ADJUST (AUSTIN)	MTL	COST	EQP COST	TOTAL	1
121 1 REPLACE (DOWNSIZE) CHILLER	RUN		2	UNIT	\$/UNIT	\$/UNIT	%	%	%	%	%	•	5	•	•	
CHILLER - CENTRIFUGAL, WATER-COOLED PIPE, STL, SCH 40, WELD, 6" ELBOW, STL, SCH 40, WELD, 6" ELBOW, STL, STD WASHT, WELD, 6" FLANGE, STL, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTERFLY, LUG, 6" INSUL, FIBERGALSS, ASJ, 1-17" THK, 6" PIPE, STL, SCH 40, WELD, 6" ELBOW, STL, STD WEHD, 6" FLANGE, STL, 150 LB, WELD NECK, 6" FLANGE, STL, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTERFLY, LUG, 6" FLANGE, STL, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTERFLY, LUG, 6" STAFTDISCON, WYE-DELTA, OPPEN, TRAPP I MOTOR CONNECTION WY ELEX CONDUIT, 128 HP WHSE, TYPE THWN, COPPER, STRANDED, 20 CONDUIT, RIGID GALV STL, 2" DEMOLITION, CHILLER-PIPING/STARTER/CCNDUIT SUBTOTAL CONTINGENCY 121 1 TOTAL 121 1 ADDIL COST (PIPING) TO RELOCATE CHILLER	138.0 10 2 1 1 1 1 1 1 1 1 1 2 3 1 1 1 2 3 1 1 1 1	1	TONS EA EE EE EE EE EE EE EE EE EE EE EE EE E	382 )( 18 50 44.00 425.00 37.00 150.00 2.5 2.5 2.5 2.5 41.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 425.00 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Table I-4. ECO-1 Calculation of Construction Cost

able	able 1-4. ECO-1 Calculation of Construction Cost											- 1			-	
PLANT MASTER ITEM	STER ПЕМ			NO HO	TI UNIT	TINO			E .				F 6	LAB E	EGP	TOTAL
BLDG CHILLER	HILLER NO	CHIL FACTOR	R ADJUST	ટાદ	TO TO	TOT)	HATE (TOT)		787	NARA P AD C	ADJUST AD	ADJUST				<u>,</u>
	<b>:</b>	ō	FACT	뚱	F.	EA.	EOP									
		I-WAY			\$00S	\$70NIT	SOS I	*	*	<u>8</u>	(AUSTIN) (AUSTIN)		•	•	4	•
135	2 ADDTL COST (EQUIP) TO REPLACE (COMB/DOWNSIZE) COOL TOWER(S)															
	COOLING TOWER - OPEN, AXIAL FAN	91.0	-	-	(S S)	7	•	١	•		•	•	5369	637	0	9009
	CONCRETE FOUNDATION SUPPORT, 12"W x 36"H	o	2			9.11	0.37	1.10	1.64	1.10	75.5	71.4	226	192	7	425
	CRANE, TRUCK MOUNTED, 12 TON	-	<del>-</del>	LIFT		•	•	•						125	400	525
	PIPE STL. SCH 40. WELD, 4"	20	2			11.00	1.38	1.10		•	0.00		416	512	5	989
	ELBOW, STL, STD WGHT, WELD, 4"	4	2 1.		17.15	81.50	10.25	1.10	1.66	5.1	100.0	70.5	151	763	8	1004
	FLANGE, STL, 150 LB, WELD NECK, 4"	၈	2			41.00	5.10	1.10			0.00		158	286	ह	478
	VALVE, IRON, BUTTERFLY, LUG, 4"	-	2 1.			81.50		1.10		•	0.00		202	175	0	377
	DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	61	<del>-</del>		•	69.00		1.10			02.4		529	140	0	333
	MOTOR STARTER, NEMA 1, 460 V, NEMA 00 (THRU 2 HP)	2	<del>-</del>		•	61.00		1.10			02.4		264	125	0	389
	MOTOR CONNECTION W/ FLEX CONDUIT, 5 HP	2	<del>-</del>			26.50	٠	1.10			02.4		00	24	0	ខ
	WIRE, TYPE THWN, COPPER, STRANDED, #14 (THRU 5 HP)	8	4			0.16		5.			02.4		R	99	0	88
	CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	8	<u>-</u>			2.37		1.10			02.4		135	241	0	376
	DEMOLITION, COOLING TOWER/PIPING/STARTER/CONDUIT	73.5 1.0	<u>-</u>	_	) ·	7		•	•	•		١	۰	515	٥	515
	SUBTOTAL												7211	3831	592	11634
	CONTINGENCY				15 %	15 %	15 %					İ	1082	575	89	1746
135	2 TOTAL												8293	4406	681	13380
135	2 ADDIL COST (EQUIP) TO ADD PRIMARY CHILLED WATER PUMP															
	PUMP FND SUCTION, 218 GPM (@ 20; 3 HP	-	+		-	204.00		1.10	1.47		0.00		1051	211	0	1262
	PIPE ST. SCH 40. WELD 4"	10	2 1.			11.00	1.38	1.10	1.65		0.00		208	256	9	494
	ELBOW, STL, STD WGHT, WELD, 4"	2	2 1.	1.00 EA	4 17.15	81.50	10.25	1.10	1.66	1.10	100.0	70.5	75	382	45	205
	REDUCER, STL, STD WGHT, WELD, 4"	-	2 1.			68.00	8.55	1.10	1.66		0.00		88	159	6	216
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 4"	-	2			51.00		1.10	1.55		0.00		792	Ξ	0	903
	FLANGE, STL, 150 LB, WELD NECK, 4"	4	2 1.			41.00	5.10	1.10	1.65		0.00		211	382	45	638
	VALVE, IRON, BUTTERFLY, LUG, 4"	-	2 -			81.50	•	1.10	1.52		0.00		202	175	0	377
	VALVE, IRON, SILENT CHECK, FLANGED, 150 LB, 4"	-	<del>-</del>			81.50		1.10	1.51		0.00		282	87	0	369
	STRAINER, IRON, Y-TYPE, FLANGED, 125 LB, 4"	-	-			136.00		1.10	1.51		0.00		189	145	0	334
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	9	2 -			2.77		1.10	1.61		0.00		43	S	0	9
	DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	-	<del>-</del>			69.00		1.10	1.50	,	02.4		8	2	0	800
	MOTOR STARTER, NEMA 1, 460 V, NEMA 0 (THRU 5 HP)	-	-			93.00		-1 -1	1.50		02.4		163	92	0	528
	MOTOR CONNECTION W/ FLEX CONDUIT, 5 HP	-	<del>-</del>			26.50	•	9	.5		05.4		₹ :	27	0	31
	WIRE, TYPE THWN, COPPER, STRANDED, #14 (THRU 5 HP)	20	₹ .			0.16		9	1.48		02.4		= :	83	0	4
	CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	20	<del>-</del>			2.37		1.10	1.50		02.4	Į	68	121	0	189
	SUBIOIAL				15 %	15 %	15 %						520	348	2 5	889
195	CONTINUENCI						2						3987	2665	180	6812
3																

APPENDIX I

135 2 135 2 135 2 135 2	ADDTL COST (EQUIP) TO REPLACE (COMB/DOWNSIZE) COND WATER PUMP(S) PUMP, END SUCTION, 262 GPM @ 25; 5 HP PIEST, SCH 40, WELD, 4* REBOW, STL, STD WGHT, WELD, 4* REDUCER, STL, STD WGHT, WELD, 4* REDUCER, STL, STD WGHT, WELD, 4* FLEAV, STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WELD, 4* FLEAV STL, STD WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT, WGHT,	CHIL FACIOR	OR ADJUST	(TOT)	(TOT)	TOT)	PAR P	MARK OH&P MARK	P ADJUST	T ADJUST	cosT	COST	cost	COST
	PUMP END SUCTION, 262 GPM @ 25; 5 HP PIPE, ST, SCH 40, WELD, 4* REDOW, STL, STD WGHT, WELD, 4* REDUCER, STL, STD WGHT, WELD, 4* FLEX CONN TWINS-SHERE NEOPHENE, FLANGED, 4* FLANGE ST, 1401 R WEI DNECK 4*	1-WAY RUN	FACTOR	COST \$/UNIT	COST \$/UNIT	SOST	%	%	(AUSTII	(AUSTIN) (AUSTIN)	•	44	5	•
	PUMP, END SUCTION, 262 GPM @ 25', 5 HP PIPE, STL, SCH 40, WELD, 4* ELBOW, STL, STD WGHT, WELD, 4* REDUCER, STL, STD WGHT, WELD, 4* FLEX CONN TWIN-SHERE NEOPHENE, FLANGED, 4* EL AND TWIN-SHERE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHENE, FLANGED, 4* EL AND THE NEOPHE	UMP(S)												
	PIPE, STL, SCH 40, WELD, 4" ELBOW, STL, STD WGHT, WELD, 4" REDUCER, STL, STD WGHT, WELD, 4" FLEX COWN, TWIN-SHERE NEOPPENE, FLANGED, 4" FLANCE, STI, 150, IR, WELD, NECK, 4"	-	1 00	FA 1150.00	226.00	•	1	1 48 1	100					
	REDUCER, STL, STD WGHT, WELD, 4 FLEX COCR, TWI, STD WGHT, WELD, 4 FLEX COCR, TWINSHERE NEOPRENE, FLANGED, 4* FLANGE STI 1501 R. WEID IN FICK 4*	5,	2 1.00	LF 9.45	11.00	1.38	2:	1.65	10 100.0	70.5	208	528	8	
	FLEX CONN, TWIN-SHERE NEOPHENE, FLANGED, 4" FLANGE, STI, 150 I B, WELD NEOK 4"	<b>u</b>	3 8		68.00	8.55	5 5							
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	VALVE IRON BUTTERELY LUG A"	4 -	8.5		41.00	5.10	2 5							
	VALVE, IRON, SILENT CHECK, FLANGED, 150 LB, 4"		8 8		81.50		2 2							
	STRAINER, IRON, Y-TYPE, FLANGED, 125 LB, 4"	_	1.00		136.00		1.10							
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4" DISCONNECT SWITCH NEMA 4 460 V, 30 A (TUB) 146 UD)	ę <b>•</b>			2.77		9.19							
	MOTOR STARTER, NEMA 1, 460 V, NEMA 0 (THRU 5 HP)	_			93.00		5.5							
	MOTOR CONNECTION W/ FLEX CONDUIT, 5 HP	-			26.50	•	1.10							
	WIRE, LYPE I HWN, COPPER, STRANDED, #14 (THRUS HP) CONDIST RIGID GALV ST: 1/2" (THRUS 4.410)	000			0.16	•	1.10				= 3			
	DEMOLITION, PUMP/PIPING/STARTER/CONDUIT	o	_		2000	500	2 '		1.10					1019
	SUBTOTAL			,	1						3681		2	1
	TOTAL			5	% 15 %	15%					552		36	
	ADDTL COST (PIPING) TO COMBINE CHILLERS												3	
	PIPE, STL, SCH 40, WELD, 4"	8	1.00		11.00	1.38	1.10							
	ELBOW, STL, STD WGHT, WELD, 4" INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	% %	2 2 2 5 3 6 5 8	EA 17.15 LF 1.95	81.50 2.77	10.25	5.5	1.66 1.61	1.10 100.0	70.5	75 86			502 212
	SUBTOTAL			!							1			
	TOTAL			15	% 15 %	15 %					664		122	
	ADDTL COST (PIPING) TO COMBINE COOLING TOWERS													l
	PIPE, STL, SCH 40, WELD, 4"		1.00	LF 9.45	11.00	1.38	1.10		1.10 100.0		624			
	DEMOLITION, PIPE, STL, SCH 40, WELD, 4"	°0 09	0.40 1.00	EA 17.15 LF	1.00	C.7.01	5 ,	1.65		70.5			135	
	SUBTOTAL			,	,									
135 2	TOTAL			15	% 15 %	45 %					978	2553	260	3791
135 3	DEMOLISH CHILLER													
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	54.9 0.40	1.00 TONS	· SNC	( 77 )	•	•	•						
	SONTINGENCY			15	% 15 %	15 %					00	1691 254	00	1691
135 3	TOTAL ADDTL COST (EQUIP) TO DEMOLISH COOLING TOWER											П		
	DEMON FION COOLING TOWER PRIOR STABILITY				í						•			
	SUBTOTAL	95.4C	3	280	<u> </u>	•	•	•		•				
135	CONTINGENCY			15	% 15 %	, 15 %						8 8	0	28 5
135 3	ADDTL COST (EQUIP) TO DEMOLISH COND WATER PUMP													
	DEMOLITION, PUMP/PIPING/STARTER/CONDUIT	1 0.40	1.00	LOT .	2000	200	•	1.65 1.10	2	- 70.5				
	CONTINGENCY			15	% 15 %	15 %					00	140	88	1019
135 3	TOTAL										0			

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Control Cost   Period of Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cost   Cos	PLANT MASTER ITEM		OTY LAS		L UNIT		NNT SARE	MARK OF	AB EQ		Sost	COST		Sost	COST
Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig. 10   Fig.	BLDG CHILLER NO NO		ACTOR AD.	TSO	Ę.		6	<b>₽</b>	2	-	ADJUST				
3 DOMENIARY PRINCIPLE STILLS SHILL WITH THE COLLER TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL TO ALL		1-WAY PUN	Ā	5	COST \$/UNIT		COST			(AUSTIN)	(AUSTIN)	•	<b>~</b>	•	•
SEROCITY PIECE STL, SCH 40, WED. 4**   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   1	9														
SHETCHE FOOWNESD CHILTRY  4 FELLOE FOOWNESD CHILTRY  4 FELLOE FOOWNESD CHILTRY  4 FELLOE FOOWNESD CHILTRY  5 CHILDS FIRST STATE STATES SHELL STATES SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SHELL SH	DEMOLITION, PIPE, STL, SCH 40, WELD, 4"	9			•	11.00	٠	-	.65		70.5		307	0	307
COMMINISTED CHILER	SUBTOTAL											0	46	0	46
Name   Comparison   Compariso	er											0	353	٥	353
OHILE STEAM WELD AFFER REPORDED 1070 1 1435 TONS 200 1 170 115 110 100 100 705 705 705 105 100 100 100 700 700 700 700 700 700 700	4														
Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_   Pipe_STI_SCH-40 WELD, CT_	CHILLER - RECIPROCATING, WATER-COOLED	107.0	-	-	249	)( //	9	•	•		' '	26643	10299	235	37477
FLEX.COMN, TWISHER KINCHER, FLANGED, 4	PIPE, STL, SCH 40, WELD, 4"	Đ '	0			2.0	1.38	- •	59.	0.001	0.0	8 %	383	S 4	50.5
Funds	ELBOW, STL, STD WGHT, WELD, 4"	N -	N 60			51.00			55	100.0		792	Ξ	0	903
NAME,   FROME DETAILS, AST, 1-17   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05   1.05	FLEX COMN, IMM-Shane NEOF SENE, FLAMOLE, F	· m	1 64			41.00	5.10	•				158	286	\$ '	478
Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe. Str.   Phe.	VALVE, IRON, BUTTERFLY, LUG, 4"	-	7			81.50	•	- '				202	175	0 0	3//
PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE WELD G.  PIPE STILL SHAPE W	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	9	~ 0			2.77	. 64					407	3 5	- E	843
FLEXONN, TWINSHERE RECORDED   1	PIPE, STL, SCH 40, WELD, 6"	2 6	N 6			127.00	10.20	•	Ť			180	577		802
FAMORE STILLS IN WILE DIRECK   1	ELBOW, OIL, OID WGAI, WELD, O		۰ ۵			68.00	•	•	•			935	151		1086
VALVE   FION BLANK   VALVE	FLEA COMM, TMIN'SHE'S ILST LANGES, CANCELS, CANC	· m	N			63.50	5.10	•				244	432		710
STATIONICON, WEELENCONDUIT, 15th   12th	VALVE IRON, BUTTERFLY, LUG, 6"	-	7			127.00	•					939	276		909
MUTCH COMMEDTION WELEX COMPUT, 135 HP   70   1   100   150   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	123	- (			5.21						9040	926 918		286
WHE, TYPE THAN, COPINGE, STATE STANDARDED, 200   COMMUTTION, CHILLEPPIPAGSTARTER/COMDUT   4   110   151   110   152   110   152   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154   110   154	MOTOR CONNECTION W/ FLEX CONDUIT, 125 HP	- F	~	3 5	900	07.00		_				416	211		627
CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY   CONTINGENCY	WIRE, TYPE THWN, COPPER, STRANDEU, 20	2 2	ŧ	8 8	8.4	4.75	•	-		·	67.8	315	340		655
COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY   COMMINGENCY	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	228.0	0.40	_	) - St	112)	•	•				0	12768	ſ	12768
CONTINGENCY	SUBTOTAL					Ţ						35056	27606	¥ ±	9512
CHILER-CENTRIFUGAL WATER-COOLED   11910   1 1.00 TONS   428   128   6   10   165   110   100.   70.5   208   256   39   100   158   110   165   110   100.   70.5   208   256   39   100   158   110   165   110   100.   70.5   208   256   39   110   100   20   20   20   20   20						0						40314	31747	867	72928
Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency   Contingency	4 9														
CHILLER - CENTRIFICOALLY WITER-COOLED  110. 1 1.00 1 4 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 1 N = 1.00 N = 1.00 1 N = 1.00 1 N = 1.00 N = 1.00 1 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00 N = 1.00			•	5			6					50694	15232	c	65926
FILEN, STI, STANDARD, WELD, 4 FILEN STI, STANDARD, WELD, 4 FILEN STI, STANDARD, WELD, 4 FILEN STI, STANDARD, WELD, 4 FILEN STI, STANDARD, WELD, 4 FILEN STI, STANDARD, WELD, 4 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 4 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 4 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN CONN, TWIN-SHERE NEOPRENE, FLANGED, 51,00 FILEN C	CHILLER CENTRIFUGAL, WATER-COOLED	0.811	- 0	-	Ø.		138	1.10	.65	0 100.0		3	256	8	494
FLEX CONN, TWIN SHERE NEOPRENE, FLANGED, 4* 10 EA 86000 51.00 1.05 1.10 1000 705 792 111 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	FIFE, S.L., SCH 40, WELD, 4	2 04	1 64			81.50	10.25	1.10	1.66 1.	0.001			385	45	502
FLANGE, STI, 150 LB, WELD NECK, 4*  1 2 1.00 EA 24.00 41.00 5.10 110 155 110 100.0 70.5 198  FLANGE STI, 150 LB, WELD NECK, 4*  1 2 1.00 EA 92.00 61.50 1.00 176 1.10 160.0 70.5 108  NAUL, FIBERGIALAS, ASJ, 1-12° THK, 4*  INSUL, FIBERGIA, AND AND AND AND AND AND AND AND AND AND	FLEX CONN. TWIN-SHERE NEOPRENE, FLANGED, 4"	-	5			51.00	•	1.10		•			111	0 3	903
NAUE, IRON, BUTTERFLY, LUG, 4*   100   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   140   1	FLANGE, STL, 150 LB, WELD NECK, 4"	e ·	64			00.14	5.10	2.5	- 1	•			175	ţ C	377
NSUL   BEHGALASA, SAJ, 11/2   THK, 4   10   12   130   142   110   153   110   100.0   70.5   407   405   31   405   407   405   31   405   407   405   31   405   407   405   31   405   407   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405   405	VALVE, IRON, BUTTERELY, LUG, 4"	- ÷	N 6			81.50		2 2	•	·				0	106
PIPE, STA WELLO, F. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LANGED, G. LA	INSUL, FIBERGLASS, ASJ, 1-1/2" I HK, 4"	2 5	<b>v</b> 0			17.60	1.42	9	-	·				31	843
FLEX CONIN, TWIN-SHERE NEOPRENE, FLANGED, 6" 110 163 110 106 100 705 935 151 10 10 164 110 165 110 100.0 705 935 151 10 10 164 110 100.0 705 935 151 10 10 100.0 705 935 151 10 10 10 10 10 10 10 10 10 10 10 10 10	FIRE, SIL, SCH 40, WELD, 6 EI ROW STI STD WGHT WELD 6*	6.01	1 (1)			127.00	10.20	1.10	_					45	802
FLANGE, STL, 150 LB, WELD NECK, 6**  FLANGE, STL, 150 LB, WELD NECK, 6**  FLANGE, STL, 150 LB, WELD NECK, 6**  VALVE, IRON, BUTTERFLY, LOG, 6**  VALVE, IRON, BUTTERFLY, LOG, 6**  STATISCOM, WORD CONDUT, 125 PP  MOTOR CONNECTION WELEX CCNIDUIT, 125 PP  MOTOR CONNECTION WELEX CCNIDUIT, 125 PP  MOTOR CONNECTION WELEX CONDUIT, 125 PP  MOTOR CONDUT, RIGID GALV STL, 1-1/2*  DEMOLTTION, CHILLER/PIPING/STARTER/CONDUIT  10.0 LF 3.15 388 - 1.10 1524 67.8 288 0  MOTOR CONDUT, RIGID GALV STL, 1-1/2*  DEMOLTTION, CHILLER/PIPING/STARTER/CONDUIT  10.0 LF 3.15 388 - 1.10 1524 67.8 288 0  MOTOR CONDUT, RIGID GALV STL, 1-1/2*  DEMOLTTION, CHILLER/PIPING/STARTER/CONDUIT  10.0 LF 3.15 388 - 1.10 1524 67.8 288 0  MOTOR CONDUT, RIGID GALV STL, 1-1/2*  DEMOLTTION, CHILLER/PIPING/STARTER/CONDUIT  10.0 LF 3.15 388 - 1.10 1524 67.8 288 0  MOTOR CONDUT, RIGID GALV STL, 1-1/2*  DEMOLTTION, CHILLER/PIPING/STARTER/CONDUIT  10.0 LF 3.15 388 - 1.10 1524 67.8 288 0  MOTOR CONTINGENCY  15.% 15.% 15.% 15.% 15.% 15.% 15.% 15.%	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	-	۲۵			68.00	' ;	0.1	- '					0 ;	1086
VALVE, IRON, BUTTERFLY, LUG, 6"  STARTOBICON, WYE DELTA, OPEN, NEMA TYPE 1 1:00 HP 28:95 5.69 - 1:10 150 1:10 102.4 67.8 9387 641 0  MOTOR CONNECTION, WHE EX CONDUIT, 125 HP 28:95 5.69 - 1:10 150 1:10 102.4 67.8 980 184 0  MOTOR CONDUIT, RIGID GALV STL, 1-1/2*	FLANGE, STL, 150 LB, WELD NECK, 6"	e .	01 0			63.50	5.10	2 5						\$ °	909
STARTIOSCOM, WTO-DELIA COMBUT, 125 HP MOTOR CONNECTION, WHE EX COMBUT, 125 HP MOTOR CONNECTION WHE EX COMBUT, 125 HP MOTOR CONNECTION WHE EX COMBUT, 125 HP MOTOR CONNECTION WHE THOUGHT, IGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT HIGH 125 HP MOTOR THOUGHT H	VALVE, IRON, BUTTERFLY, LUG, 6"	- 0	N •			5.60		2 5						0	4228
MUCHANEZIONA WILLEANDONI, 124 MC MCHANACOPPER, STRANDONI, 124 MC MCHANACOPPER, STRANDONI, 124 MC MCHANACOPPER, STRANDONI, 124 MC MCHANACOPPER, STRANDONI, 124 MC MC MC MC MC MC MC MC MC MC MC MC MC	START/DISCON, WYE-DELTA, OPEN, NEMA 1 YPE 1	2 -	- ۵			107.00	•	2						0	286
WHIGH THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONDUIT REPORT OF THE PROPERTY CONTINGENCY TO THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY THE PROPERTY CONTINGENCY T	MOTOR CONNECTION W/ PLEA CONDUIT, 129 NF	70	1 4			0.65	•	1.10					184	0	544
DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT 110.0 0.40 1.00 TONS · ( 129 ) · · · · 58531 25341 219 SUBTOTAL CONTINGENCY 15 % 15 % 15 % 15 % 15 % 15 % 15 % 15	CONDUIT BIGID GALV STL 1-1/2"	20	-			3.88	•	1.10	•				276	0 (	524
SUBTOTAL SUBTOTAL SUBTOTAL SUBTOTAL SUBTOTAL 67311 29142 252	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	110.0	0.40	-	) ·	129)	•	•				58531	25341	200	84091
CONTINGENCY 67311 29142 252	SUBTOTAL					ţ						8780		33	12614
						2						67311	ı	252	96705

**APPENDIX I** 

Table I-4.	4. ECO-1 Calculation of Construction Cost															
PLANT MASTER ITEM BLDG CHILLER NO NO	TER ITEM LER D	QTY QTY PER ADJUST CHIL FACTOR /	/ LABOR ST DIFFIC OR ADJUST	NI NI	UNIT BARE (TOT)	UNIT BARE (TOT)	UNIT BARE (TOT)	MTC LAB EOP MARK OH&P MARK UP UP	AB ECHASP MA	AK COST P ADJUST	L LAB ST COST JST ADJUST	T COST	T COST	EQP T COST	TOTAL	بر با
		1-WAY	FACTO				EOP COST S/UNIT	*	*	(AUS	(AUSTIN) (AUSTIN)	Ž.	42	47	s	
2805 8	REPLACE (DOWNSIZE) CHILLER									1						ı
	CHILLER - RECIPROCATING, WATER-COOLED	116.0	1.00	TONS	254 )(	)( 77	5)	•								926
	PIPE, STL, SCH 40, WELD, 4" ELBOW, STL, STD WGHT, WELD, 4"	5 2	2 2	<u></u>	9.45	11.00	1.38	5 5	66.	5 5 5 5	100.0 70.5	5 208	08 256 75 382	30 30		494 502
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 4"	-		EA	360.00	51.00		1.10								903
	FLANGE, STL, 150 LB, WELD NECK, 4" VALVE IBON BLITTERELY 1100 4"	en +	- •	Δí	24.00	41.00	5.10	9.5								178
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	- 0		Ž L	1.95	2.77		2 9								90
	PIPE, STL, SCH 40, WELD, 6"	9	-	۳.	18.50	17.60	1.42	1.10								5 25
	ELBOW, STL, STD WGHT, WELD, 6"	8		Ε	41.00	127.00	10.20	1.10					180 57			05
	FLEX CONN, I WIN-SHERE NEOPHENE, FLANGED, 6" FLANGE, STL 150 LB, WELD NECK, 6"	- 67	2 2	¥ 4	425.00 37.00	68.00	5 10	5 5		1.10					9 7	98
	VALVE, IRON, BUTTERFLY, LUG, 6"	-		Ā	150.00	127.00		1.0				330				9 9
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	134	1.00	£	29.34	4.80		1.10								87
	MOTOR CONNECTION W/ FLEX CONDUIT, 150 HP	- 6	2.5	ب - للـ	67.8	119.00		5.5								8 1
	CONDUIT, RIGID GALV STL. 2"	2 2	4 +	5 5	20.4	4.75		2 9			67	0 00	315 32			22
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	149.8 0.	0.40 1.00	TONS	•	126)		'								9
	SUBTOTAL				,		,					38304		662 21		င္သ
2805 8					<u>%</u>	% CI	% CI					5/46	50 24204		1	2 2
2805 8													1			2
	PIPE, STL, SCH 40, WELD, 4"	10			9.45	11 00	1.38	1.10				5	26			194
	ELBOW, STL, STD WGHT, WELD, 4"	2			17.15	81.50	10.25									8 2
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	우 :			1.95	2.77	•									90
	FIRE, SIL, SUH 40, WELD, 6" ELBOW, STL, STD WGHT, WELD, 6"	<u>o</u> ~	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	<u> </u>	18.50	17.60	10.20	2 9	8 6 	1.10	100.0 70.5					843 00 00
	SUBTOTAL												ľ			47
2000					15 %	15 %	15 %					2	137 252		23	412
5764	DELACE (COMBINE COMMISSIZE) CILI I EB/SI											Ď			1	20
	CHILLER - CENTRIFUGAL, WATER-COOLED	201.0	1.25	SNOT	294 )(	117 )(	0					. 29	ଷ			38490
	FIRE, S.L., SCH 40, WELU, 6.  FIREM STI STO WOLT WELD 6.	2 "	8.5	<u> </u>	18.50	17.60	1.42									£ 6
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"			S A	425.00	68.00	2	100	•	10			935 15			98
	FLANGE, STL, 150 LB, WELD NECK, 6"	. С	_	Æ	37.00	63.50	5.10		•					432 3		9
	VALVE, IRON, BUTTERFLY, LUG, 6"	-:	_	¥.	150.00	127.00			_	10						906
	INSUL, FIBERGLASS, ASJ, 1-1/2" IRK, 6" PIPE STI SCH 40 WFI D 6"	2 9		<u>.</u> u	18 50	3.52	1 42						20			00 5
	ELBOW, STL, STD WGHT, WELD, 6"	2 04	_	ă	41.00	127.00	10.20	•	-	10				577		202
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	-	2 1.00	Ā	425.00	68.00		•	_							986
	FLANGE, STL, 150 LB, WELD NECK, 6"	e ,	_ `	Δi	37.00	63.50	5.10	•								10
	VALVE, IRON, BUTTERFLY, LOG, 6-STABITORSON WAYE-DELIA OPEN NEMATYPE 4	- 183	_	£ 5	28.00	127.00						5 330				90
	MOTOR CONNECTION W/ FLEX CONDUIT, 200 HP	3 -	2 2 2	Ā	79.00	142.00	•			•						67
	WIRE, TYPE THWN, COPPER, STRANDED, 250 MCM	0.1	0.1	<b>5</b>	2.35	1.07	•	1,10	1.51	1.10	102.4 67.8			307	0	1048
	DEMOCITION, CHILLER/PIPING/STARTER/CONDUIT	178.0 0.40	-		0/9	121		١.								29.59
	SUBTOTAL											70748				43
5764 0	CONTINGENCY				15 %	15 %	15 %					10612	12 6851	33	- 1	96
١	١											0130	- 1	1	- 1	8

NO SED	BLDG SHILER NO NO	PER CHIL	ADJUST FACTOR	QTY LABOR UN ADJUST DIFFIC FACTOR ADJUST	BARE (TOT)	UNIT BARE (TOT)	BARE (TOT)	MARK UP	K OH&F	COHSP MARK	MTL COST ADJUST	COST ADJUST	MTL COST	COST	EOP	TOTAL COST
5764	9 AÓDTL COST (EQUIP) TO REPLACE (UPSIZE) COCÁ ING TOWFR	1-WAY RUN		FACTOR	COST \$/UNIT	COST \$/UNIT	COST \$AUNIT	*	%	*	(AUSTIN)	AUSTIN)	•	<b>~</b>	•	₩
	COOLING TOWER - OPEN AXIAL FAN	0.00	•	4 60											1	
	CONCRETE FOUNDATION SUPPORT, 12"W x 36"H	. G	- 64 -		LF 15.11	9.11	0.37	1.10	1.64	1.10	75.5	71.4	9045 226	1905	7 0	10050
	PIPE, STL, SCH 40, WELD, 6"	- 02	- 0				1 42				' c	, 40,	. 3	125	8	525
	ELBOW, STL, STD WGHT, WELD, 6"	4	10			127.00	10.20	5.5		5 2	100.0	70.5	361	1153	8 8	5 5 5 5
	VALVE, IRON, BUTTERFLY, LUG. 6"	e +	o o			63.50	5.10	5.5		5.5	100.0	70.5	244	432	중 '	7
	DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	- +-	4			69.00	•	1,10		5 5	100.0	67.8	330	276	0 0	8 8
	MOTOR STARTER, NEMA 1, 460 V, NEMA 1 (THRU 10 HP) MOTOR COMMECTION W/ ELEX CONDUIT 40 HB		-	0.5 H	EA 165.00	134.00	٠	1.10	1.52	5	102.4	67.8	188	138	0	3 8
	WIRE, TYPE THWN, COPPER, STRANDED, #10 (THRU 10 HP)	50	- 4			26.50	•			9.5	102.4	67.8	₹ 5	27	0 (	'nί
	CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	200				2.37		5 2		2 2	102.4	67.8	× 8	₹ ₹	0	18 /
	DEMOLITION, COOLING TOWERPPING/STARTER/CONDUIT SUBTOTAL	178.0	8.	-	NS .	. 5	•			•	•	.'	0	880	٥	89
5764	CONTINGENCY 9 CONT. 10 DELOTAL 10 DELOTAL			_	15	% 15	% 15	%				'	11435 1715 13150	5281 792 6073	593 682	17309 2596 19905
<b>*</b>																
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT SUBTOTAL	71.6	0.40	1.00 TONS	. SN	06 )			•	•	٠	.'	0	2578	0	257
5764	CONTINGENCY 10 TOTAL				15	15 %	% 15	%				'	00	387	0 0	387
5764	10 ADDTL COST (PIPING) TO DEMOLISH CHILLER													2862	٥	8
	DEMOLITION, PIPE, STL, SCH 40, WELD, 4", w/ TRACING	220	0.60	1.00 LF		11.00	•		- 1.65	•	•	70.5	0	1689	0	168
	CONTINGENCY				15	751	15.	*					0 6	1689	0 0	1689
5764	10 TOTAL 11 REPLACE CHILLER					2	2					'	0	1942	0	1942
!		170.0	-		FONS	>	ć						0000	0000	•	
	PIPE, STL, SCH 40, WELD, 6"	10	8		18	<	1.4	1.10		1.10	100.0	70.5	407	405	3.0	28
	ELBOW, SIL, SID WGHT, WELD, 6" FLEX CONN TWIN-SHERE NEODRENE ELANDED 6"	C1 +	C) C			127.00	10.20	1.10		1.10	100.0	70.5	180	577	45	8
	FLANGE, STL, 150 LB, WELD NECK, 6"	- ღ	N (N			63.50	5.10	1.10		0 5	100.0	70.5	935	151	٥,	<u> </u>
	VALVE, IRON, BUTTERFLY, LUG, 6*	ត់ :	2			127.00		-		1.0	100.0	70.5	330	276	, 0	. 8
	PIPE, STL, SCH 40, WELD, 6"	2 2	0 0	9.1		3.52	' 67 +	5.5		5.5	100.0	70.5	8 5	8 5	۰;	5 5
	ELBOW, STL, STD WGHT, WELD, 6"	OI.	2			127.00	-	5.		0	100.0	70.5		577	£ 5	2 8
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	- (	~ (			68.00		1.10		1.10	100.0	70.5		151	90	8 8
	VALVE, IRON, BUTTERFLY, LUG, 6"	n <del>-</del> -	N 0			127.00	5.10	5.5		5 5	0.00	70.5		432	34	7.5
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	152	-			4.18	•	1.0		5 5	102.4	67.8	5061	650	0	57.0
	WIRE, TYPE THWN, COPPER, STRANDED, 3/0	- 2	N 4	1.00 LF	1.65	142.00		5.5	5.50	 	102.4	67.8 67.8		289	0 0	467
	CONDUIT, RIGID GALV STL, 2" DEMOLITION CHILLER/DIDING/STABTED/CONDUIT	07	- 5	,		4.75	•	1.10	•	5	102.4	67.8		340	0	93
	SUBTOTAL	2,00	9	_	ņ	22				•	•	.1	- 1	10455	٥	1045
6700	CONTINGENCY				15	% 15	% 15.9	.0					9988	6282	3 8	1630
35														40450	250	124986

APPENDIX I

Table I-4. ECO-1 Calculation of Construction Cost

PLANT MASTER ITEM	100	(1)		ŀ												
ō		4						Ž.	28			2	MIL	LAB	EOP	TOTAL
ON ON	1	-	A PIECE	à t		BAHE	BAH H	MARK	OH&P	MARK				COST	COST	COST
	, o	-	FACTOR		Ē	( a		3			ADJUST A	ADJUST				
	1-WAY	>		: ö		COST	COST			,	ICTAIN /A	CTINIC				
7050 12 REPLACE (DOWNSIZE) CHILLER	P.G.			\$.V		S/UNIT	\$/UNIT	%	*	<u>.</u>	(MILEON) (MILEON)	<u> </u>	•	•	ø	•
(13 SIM)																
CHILLER - CENTRIFUGAL, WATER-COOLED	153.0	-	1.10 TC		351 1/	125 1/	6									
FIFE OIL, SCH 40, WELD, 6"	-	0	_	<u>-</u>	18.50	17.60	1.42	1.10	8		, 6	. 402	53/03	21038	0 ;	74741
ELBOW, OLL, OLD WGHI, WELD, 6"		2				127.00	10.20	10	2 2		2 5	2 2	2 5	5 5	5 4	843 843
FLANCE STI 450 D MEIO MEON ST		1 2	1.00	•		68.00		5	1.58	10	1000	202	93.5	151	ů c	200
VALVE JRON RETTERE VIOLE 6		8				63.50	5.10	1.10	1.61		100	70.5	244	432	5	240
INSUIT FIREBOLDS AND 1-100, 6		7				127.00	٠	1.10	1.54		100	70.5	330	276	5 <	2 9
PIPE STL SCH 40 WELD 6"	-	0				3.52	٠	1.10	1.61		1000	70.5	2	2	0 0	3 5
ELBOW, STL. STD WGHT WFI D 6"		0 0				17.60	1.42	1.10	<b>1.</b> 83		100.0	70.5	407	405	3.	843
FLEX CONN. TWIN-SHERF NEDBRENE FLANDED AT		~ .				127.00	10.20	1.10	1.61		100.0	70.5	180	577	5	802
FLANGE, STL, 150 LB. WELD NECK, 6"				•		68.00	•	1.10	1.58		100.0	70.5	935	151	0	1086
VALVE, IRON, BUTTERFLY, LUG, 6"						63.50	5.10	1.10	1.61		100.0	70.5	244	432	34	710
START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	130			_		00./2	•	9	<u>z</u>		0.0	70.5	330	276	0	909
MOTOR CONNECTION W/ FLEX CONDUIT, 150 HP	2				13.30	9.79	•	1.10	1.5		102.4	67.8	4465	658	0	5123
WIRE, TYPE THWN, COPPER, STRANDED, 2/0	7		8.5	<b>4</b>		119.00	•	-10	5		102.4	67.8	106	242	0	348
CONDUIT, RIGID GALV STL. 2"		•		5 !	1.32	0.74	•	-10	1.51	<u>.</u>	92.4	67.8	416	211	0	627
DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	2100	- 6	-		8.	4.75	•	1.10	5.	9	02.4	67.8	315	340	0	655
SUBTOTAL	6.00		_	Š	-	116)	•	•	•			٠,١		10718	0	10718
							•							36969	220	100436
12 (13)					% 61	, cl	15 %					-	- 1	5545	33	15065
7051 14 REPLACE (DOWNSIZE) CHILLER													72734 4	42514	253	115501
CT 1000 CTT. 11 CTT CTT CTT CTT CTT CTT CTT CTT CTT																
DIDE STI SCH AN WELD ST	158.0	-	`_	LONS	345 )(	125 )(	0	•	1				54510 2	21726	c	20005
FIRM STINET WOLL ST	7	5	1.00 L	F. 16		17.60	1.42	1.10			000			406	2 5	C679/
FLEX CONN TWIN, SHEEP NEODER OF ANDER OF			1.00 E	¥.		27.00	10.20	1.10			000	70.5	180	27.5	45.	3 8
FLANGE, STL. 150 I B. WELD NECK 6"		2	9. H	A 425		68.00		1.10		1.10	0.00	70.5	935	151	9 0	1086
VALVE IRON BUTTERELY LITE &		N .	1.00	37		63.50	5.10	1.10			0.00	70.5	244	432	2	210
INSUL, FIBERGLASS, ASJ, 1-10", THK 6"		N C				27.00	•	1.10			0.00	70.5	330	276	0	606
PIPE, STL. SCH 40, WEID 6"	2 ;	N (				3.52		1.10			0.00	70.5	20	8	0	130
ELBOW STL STD WGHT WEID 6"	2 '	N 6	1.00		18.50	17.60	1.42	1.10	1.63	1.10	100.0	70.5	407	405	3	843
FLEX CONN, TWIN-SHERE NEOPRENE ELANGER 6"						27.00	10.20	1.10			0.00	70.5		277	5	802
FLANGE, STL, 150 LB, WELD NECK, 6"	- 0	NI C			425.00	68.00	•	1.10			0.00	70.5		151	0	1086
VALVE, IRON, BUTTERFLY, LUG. 6"	•	4 (				53.50	5.10	1.10			0.00	70.5		432	34	710
START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	140	٠.				27.00		1.10			0.00	70.5		276	0	909
MOTOR CONNECTION W/ FLEX CONDUIT 150 HP	*	- (				4.57		-10			02.4	67.8		655	0	5298
WIRE, TYPE THWN, COPPER, STRANDED, 3/0	- 2	٧ ٦		4		119.00		2			02.4	67.8		242	0	348
CONDUIT, RIGID GALV STL, 2*	2 5	•			8 5	0.85		9			02.4	67.8		243	0	763
DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	170 0	040	1.00		3	4.75		-10			02.4	67.8		340	0	655
SUBTOTAL		2	-	2	_	(53)		•				ا .		9200	0	9200
					15 %	45 0/	9					9		6167	520	100723
7051 14 TOTAL						9/. C	20					ľ	ľ	5425	g	15108
												,	73986 4	41592		115831

# **APPENDIX!**

Table I-4. ECO-1 Calculation of Construction Cost

DI ANI	WALL TO	DI ANT WASTED THEM																
80.00	BLDG CHILFR			ary L		UNIT UNIT			LIND	W	AR	1	i i i	-	- 1	-1	ľ	
2	õ		PER AL	ADJUST D	FFIC	BA			BARE	~	•	MARK		COST	COST	Sost	200	SOST
				2 Z	FACTOR			(je)	Ę	5	_		ADJUST AD	-				5
			1-WAY	:		Ö			COST			147	STIMI (A)	CTIN				
14020	8	NEPLACE (UPSIZE) CHILLER	RUN			\$Q			NUNIT	%	%	%	% % %		•	s	•	•
										!								
		PIPE STI SCHAMMEN S.	154.0	-	•		320)(	125)(	0	•					00000	04060	•	
		FIROW STI STO WORLY WELD 6.	9	8	8.			17.60	1.42	1.10				•		3 4	٠,	36
		FLEX CONN TWIN.SHERE NEODERNE ELANDED 6*	2	7				27.00	10.20	1.10				70.5	9 6	1 2	5	24.0
		FLANGE STI 150 I B WEI D NECK 6"	- 1	~	8			68.00	•	2				70.5		177	ů d	208
		VALVE IRON, BUTTEREY / 100 PT	ю,	2				53.50	5.10	1.10				70.5		435	5	1000
		INSTITUTE FIREBULANS AND 1-10-THE F.	- :	8				27.00	,	5				70.5		326	<b>*</b> •	2 6
		PIPE STI SCH 40 WEID 6"	2	C4	_			3.52		5	1.61	1.10	1000	70.5	3 5	0 0	<b>&gt;</b> c	2 5
		ELBOW STI STD WGHT WEID A"	Q *	2	_				1.42	1.10				70.5		8 6	7	200
		FIEX CON TWIN SHEEP MEDDENIE CLANOTO	. 2	8					10.20	1.10				70.5		2 5	5	2 3
		FLANGE AT 150 D MEI D MONEY 6"	-	C)						1.10				70.5		7	ů.	206
		VALVE IBON BUTTEDE VIIV.	က	8				33.50	5.10	0				20.07		2 5	٠;	1086
		STABLISCON WAT DELT LOG 6"	-	~		•		27.00		9				0.07		432	8	710
		MOTOD COMMITCHIST IN THE COMMITCH AND TABLES	135	-				4.76		2 5				0.5		276	0	909
		MOLOGICONNECTION W/ FLEX CONDUIT, 150 HP	-	2		A 47 00	÷	10.00		2 5				8.79		658	0	5123
		WINE, 17PE IHWN, COPPER, STRANDED, 3/0	2	4				98.0	, ,	2 5				87.8		242	0	348
		CONDUIT, HIGID GALV STL, 2"	20	-			00.4	7.00		2 9				67.8		243	0	763
		DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	140.4	0.40	1.25 TO	SNO	,	127		2.1				8.79		340	0	655
		SUBTOTAL			•	2	-	131	•					.		915		8915
,	8						15 %	15 %	4 4					6		38223	220 10	01991
14020	3	Į							2							733		15298
14020	20	ADDTL COST (EQUIP) TO REPLACE (UPSIZE) COOLING TOWER												7	73080 43	3956	۰	17289
		MAT 11554 MORO - BONN LOCAL																
		CONCRETE FOUNDATION SUPPORT 10"W v 36"LI	154.0	<del></del> (	1.00 TONS		ĭ	(9						,	_	PC0		9460
		CRANE, TRUCK MOUNTED, 12 TON	2 -	ν.	_	F 15.11		9.11	0.37	1.10	1.64	1.10 7	75.5	4.17	301	256		567
		PIPE, STL, SCH 40, WELD 6"	- 8	- 0						•						125		200
		ELBOW, STL, STD WGHT, WELD, 6"	3.	N C		18.50			1.42	1.10		1.10 10		70.5	814	809	3	1685
		FLANGE, STL, 150 LB, WELD NECK, 6"	re	40				127.00	0.20					70.5		153		1604
		VALVE, IRON, BUTTERFLY, LUG, 6"	-	10					5.10		1.61		100.0	70.5	244	432		710
		DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	۰ ۵					9.0	•					.0.5		276		909
		MOTOR STARTER, NEMA 1, 460 V, NEMA 0 (THRU 5 HP)	. 6	-				00.00						97.8		140	0	339
		MOTOR CONNECTION W/ FLEX CONDUIT, 5 HP	. 0	-				3 9						17.8		189	0	516
		WIRE, TYPE THWN, COPPER, STRANDED, #14 (THRU 5 HP)	100	4				0.00						9.7		54	0	62
		CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	100	-				2.70	•					17.8	ន	99	0	88
		DEMOLITION, COOLING TOWER/PIPING/STARTER/CONDUIT	140.4	. 8	100		,	٠ د						7.8		241	0	376
		SUBLOTAL				!	-	5	•	•						842	0	842
44000	8	CONTINGENCY					15 %	15 %	15 %					₽ .	10194 55	2055	596 1	16297
14020	8	IOIAL.						?	2					- -		-	-	2444
														-	11723	6333	ľ	8741

APPENDIX I

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ECO-1 Calculation of Construction	
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PLANT	MAS	PLANT MASTER ITEM		INI BOR	TI UNIT	7 188FF	E	Ė				- 1	- 1	- 1		
BLDG CHILLER	CHILL	LER	PER ADJUST	DIFFIC	BARE	BARE	RABE	MARK	2 2				- 1300 - 1300	LAB EQP	Ι.	TOTAL
2	Z		CHIL FACTOR ADJUST	ADJUST	(F)	(TOT)	(TOT)	5		NP AD	ADJUST ADJ	ADJUST C				200
			1-WAY	TAC OF	COST	COST	9 5 5 5 7				or the value	1				
14023	2	1 REPLACE (UPSIZE) CHILLER	RUN		\$/UNIT	\$/UNIT	\$/UNIT	%	%	₹ *	(AUSTIN) (AUSTIN) % %		69	9		
		CT ICCC GTTW IVG DIGITAL AND THE														
		PIPE STL SCH 40 WEI D 6*	166.0	Š	S 336)	( 123 )(	0	•	٠			. 55		25523	_	1299
		ELBOW, STL. STD WGHT WEID 6"	10	<u></u> 등 ;	18.50	17.60	1.42	1.10	8		0.00	20.5		405	•	843
		FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED 6"	2 -	8 E	41.00	127.00	10.20	1.10	1.61	1.10	100.0		180	577	45	802
		FLANGE, STI, 150 LB, WELD NECK, 6"	- 6	Š	425.00	68.00	' ;	2	1.58				935	151		1086
		VALVE, IRON, BUTTERFLY, LUG, 6"		ត៍ ជ	37.00	63.50	5.10	1.10	9.			70.5	244	432		710
		INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"		, n	00.00	00.721	•	9	1.54			70.5	330	276		909
		PIPE, STL, SCH 40, WELD, 6"	10	5 4	18 50	3.52	' <u>\$</u>	1.10	1.61			70.5	20	80		130
		ELBOW, STL, STD WGHT, WELD, 6"		ŭ	5	7.00	24.0	2 :	3			20.5	407	405		843
		FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"		ξ <u>π</u>	425.00	00.721	10.20	2.5	5.6			20.5	180	277		802
		FLANGE, STL, 150 LB, WELD NECK, 6"	3 .	<b>₹</b>	37.00	69.60	, 6	2:	8,5				932	151		1086
		VALVE, IRON, BUTTERFLY, LUG, 6"		5	450.00	103.00	0.0	2 ;	1.61				244	432		710
		START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	148	5 5	20.00	8.73		0.10	5.5				330	276		909
		MOTOR CONNECTION W/ FLEX CONDUIT, 150 HP	- 6	L v	73.57	4.27	,	1.10	.5			4	1930	647		5577
		WIRE, TYPE THWN, COPPER, STRANDED 3/0	- 02	, .	47.00	00.61		-10	1.50				106	242		348
		CONDUIT, RIGID GALV STL, 2"	0,0	5 5	2.62	0.86		9:	1.50				520	243		763
		DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	146.0 0.40	֡֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	00.4			9	1.51					340		655
		SUBTOTAL		_	•	126)		•	٠					9198	0	9198
		_			45.00	į						65	•		-	9090
14023	~				% 61	% C!	15 %					6			33	5909
14023	21	ADDTL COST (EQUIP) TO REPLACE (UPSIZE) COOLING TOWER										75	75772 45	15948 2	-	21973
		COCLING TOWER - OPEN, AXIAL FAN	166.0	1.00 TONS	46)(			٠	•							6630
		CRANE TRUCK MOUNTED 19 TON	12 2			9.11	0.37	1.10	1.64	1.10	75.5 7	4.	301			567
		PIPE, STL, SCH 40 WEI D 6"	- 0												2 00	525
		ELBOW, STL, STD WGHT WEILD 6"	20		18.50	17.60	1.42					20.5	814			1685
		FLANGE, STL, 150 LB, WELD NECK, 6"	7 0			127.00	10.20									1604
		VALVE, IRON, BUTTERFLY, LUG, 6"	2 -	9.5	37.00	63.50	5.10	1.0	1.61	1.10	100.0	70.5	244			710
		DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	- 0			127.00	1							576		909
		MOTOR STARTER, NEMA 1, 460 V, NEMA 0 (THRU 5 HP)	• •			99.00								40		333
		MOTOR CONNECTION W/ FLEX CONDUIT, 5 HP				93.00	,							189		516
		WIRE, TYPE THWN, COPPER, STRANDED, #14 (THRU 5 HP)	100			20.50								54		62
		CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	100			2 2 2								99		83
		DEMOCITION, COOLING TOWER/PING/STARTER/CONDUIT	146.0 1.00	_		9	. ,							241	0 0	376
		CONTINCENCY										È	ı		I.	0/0
14023	5				15 %	15 %	15 %					2 +			-	1000
1000	4	NIO!					:					100	12004		500	243/
												70				3144

22 22 22 22 24002 22 24002 22 24002 22 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 24002 2400000000	REPLACE (UPSIZE) CHILLER CHILLER - CENTRIFUGAL, WATER-COOLED PIPE, STL, SOH 40, WELD, 6* ELBOW, STL, STD WGHT, WELD, 6* FLEX CONI, TWINS-HERE NEOPRENE, FLANGED, 6* FLANGE, STL, 150 LB, WELD NECK, 6* VALVE, IRON, BUTTER-LY, LUG, 6* INSUL, FIBERGLASS, ASJ, 1-16* THK, 6* INSUL, FIBERGLASS, ASJ, 1-16* THK, 6* INSUL, STL, STD WGHT, WELD, 6* FLEX CONN, TWINS-HERE NEOPRENE, FLANGED, 6* FLEX CONN, TWINS-HERE NEOPRENE, FLANGED, 6* FLEX CONN, TWINS-HERE NEOPRENE, FLANGED, 6* STARTIOISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY FLEX CONDUIT, 280 HP WHIE, TYPE THWN, COOPPER, STRANDED, 350 MCM CONDUIT, RIGIO GALV STL, 3*	1-WAY FUN N FUN S 10 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	FACTOR 1.00 TH 1.00 EA 1.00 EA	MTL COST \$/UNIT \$/UNIT 15/00 15/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 16/10 1	COST	COST			-	TIAN (ALL					
55	REPLACE (UPSIZE) CHILLER CHILLER, CENTRIFUGAL, WATER-COOLED PIPE, STL, SCH 40, WELD, 6* ELBOW, STL, STD WGHT, WELD, 6* ELEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLANGE, STL, 150 LB, WELD NECK, 6* VALVE, IRON, BUTTERELY, LUG, 6* INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6* PIPE, STL, SCH 40, WELD, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* STARTIOISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY FLEX CONDUIT, 250 HP WHIE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGIO GALV STL, 3*	240.0 10 20 10 20 10 10 10 10 10 10 10 10 10 10 10 10 10			NOW!	\$\UNIT	%	*	(AUS	(AUSTIN) (AUSTIN)				50	<b>S</b>
<u> </u>	CHILLER - CENTRIFUGAL, WATER-COOLED PIPE, STL. SCH 40, WELD, 6° ELBOW, STL. STD WGHT, WELD, 6° ELE SCNI, TWINSHERE NEOPRENE, FLANGED, 6° FLANGE, STL, 150 LB, WELD NECK, 6° NISUL, FRENGLASS, ASJ, 1-1/2° THK, 6° PIPE, STL, SCH 40, WELD, 6° FLEX CONN, TWINSHERE NEOPRENE, FLANGED, 6° FLEX CONN, TWINSHERE NEOPRENE, FLANGED, 6° FLANGE, STL, 150 LB, WELD NECK, 6° VALVE, IRON, WELD NECK, 6° STAFTOBSCON, WTE-DELTA, OPEN, NEMA TYPE 1 STAFTOBSCON, WTE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WF LEX CONDUIT, 250 HP WHIE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3°	240.0												•	0071
ᅐᄪᇎᇎᇰᆇᇲᄥᇿᇿᄼ	PIPE, STL, SCH 40, WELD, 6° ELBOW, STL, STD WGHT, WELD, 6° ELE BOW, STL, STD WGHT, WELD, 6° ELE STL, 150 LB, WELD NECK, 6° FLANGE, STL, 150 LB, WELD NECK, 6° INSUL, FRENGLASS, ASJ, 1-1/2° THK, 6° PIPE, STL, SCH 40, WELD, 6° PIPE, STL, SCH 40, WELD, 6° PIPE, STL, SCH 40, WELD, 6° PIEL SCOWI, TWINSHERE NEOPRENE, FLANGED, 6° FLEX CONN, TWINSHERE NEOPRENE, FLANGED, 6° FLANGE, STL, 150 LB, WELD NECK, 6° VALVE, IRON, WELE DELTA, OPEN, NEMA TYPE 1 STAFFIOSCON, WTE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WF LEX CONDUIT, 250 HP WHIE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3°	5 2 4 5 5 5 5 6 5 6 5 6 5 6 5 6 5 6 5 6 5 6			×	~	, 61						405	3 5	843
<b>□ ፫ ፫ &gt; ≤ 0. W L L &gt; </b>	FLENOW, SIL, SID WASH, WELD, OF FLENGED, OF FLEX COWN, TWINS-SHERE NEOPRENE, FLANGED, OF FLAXCE, STL, 1501B, WELD NECK, OF VALVE, IRON, BUTTERFLY, LUG, OF STL, SCH 40, WELD, OF ELBOW, STL, SCH 40, WELD, OF FLEX COWN, TWIN-SHERE NEOPRENE, FLANGED, OF FLANGE, STL, 1501B, WELD NECK, OF START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MONTOR CONNECTION WY FEX CONDUIT, 250 HP WING, COPPER, STRANDED, 350 MCM CONNECTION WY FEX CONDUIT, 250 HP WING, TYPE THWN, COPPER, STRANDED, 350 MCM CONNECTION WY FEX CONDUIT, 250 HP	1 - 8 - 1 0 0 0 1 - 8 - 75		-		10.20	1.10				70.5		577	<b>5</b>	805
· █ ≯ ≦ ɑ W Œ Œ ≯ v	FLÄNGE, STL, 150 LB, WELD NECK, 6* VALVE, IRON, BUTTERFLY, LUG, 6* INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6* PIPE, STL, SCH 40, WELD, 6* ELBOW, STL, STD WGHT, WELD, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6* FLEX CONN, TWIN-SHERE, NEOPRENE, FLANGED, 6* START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY EEX CONDUIT, 250 HP WING, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3*	e + 0 0 a + e + 70 a a a a a a a a a a					<del>-</del> -				70.5		132	, ¥	710
<b>&gt;</b> ₹ ₢ ₪ ₶ ₶ > ‹	NATVE, INCN, BOTTENT, L.D.G., BOTALLE, INCN, BOTTENT, L.D.G., BOTTENT, BERGALDASS, ASJ, 1-1/2" THK, 6" PIPE, STL, SCH 40, WELD, 6" ELBOW, STL, STD WGHT, WELD, 6" ELBOW, STL, STD WGHT, WELD, 6" FLANGE, STL, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTENELY, LUG, 6" START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY ELX CONDUIT, 250 HP WIRE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3"	000000000000000000000000000000000000000					2.0				70.5		276	0 0	909
: â iii ii: ii > v	PIPE, STL, SCH 40, WELD, 6" ELBOW, STL, STD WGHT, WELD, 6" FLEX CONN, TWIN-SHERE NEOPENE, FLANGED, 6" FLANGE, STL, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTERFLY, LUG, 6" STARTIOISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY ELX CONDUIT, 250 HP WIRE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3"	10 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2					9.5				70.5		8 Q 9 S	٥ ټ	843
<b>™</b> II IL > (	FLEX CONN, STL, STD WGHT, WELLD, B. FLEX CONN, TWIN-SHERIE NEOPRENE, FLANGED, 6* FLANGE, STL, 150 LB, WELD NECK, 6* VALVE, IRON, BUTTERFLY, LUG, 6* STARTIOISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CONNECTION WY ELX CONDUIT, 250 HP WIRE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3*	11.81.				10.20	2 2				70.5		277	5	805
(iL > t	FLANGE, ST., 150 LB, WELD NECK, 6* VALVE, IRCM, BUTTEFFY, LUG, 6* STARTIOISCON, WYE-DELTA, OPEN, NEWA TYPE 1 MOTOR CONNECTION WY ELEX CONDUIT, 250 HP WIRE, TYPE THAM, COPPER, STRANDED, 350 MCM CONDUIT, RIGIO GALV STI, 3*	3 1 2 2 2			0 68.00		1.10	. 58	55	100.0	70.5	935	151 432	o %	710
> 1	VALVE, IHCM, BOTTETT, LOG, O START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1 MOTOR CCANEGTION W/ FLEX CONDUIT, 250 HP WIRE, TYPE THVM, COPPER, STRANDED, 350 MCM CONDUIT, RIGIO GALV STL, 3*	100					1.10				70.5		276	0	909
,	MOTOR CONNECTION W/ FLEX CONDUIT, 250 HP WIRE, TYPE THWN, COPPER, STRANDED, 350 MCM CONDUIT, RIGID GALV STL, 3"	- Personal				•	9.5				67.8 67.8		393	00	/953 625
. 2	WIRE, TYPE THWN, COPPER, STRANDED, 330 MCM CONDUIT, RIGID GALV STL, 3"	- 2			=		5 5				67.8		339	0	1332
> (	CONDOIL, FIRST CALL, OLD	22			0 8.55	•	1.10				8.79		621	0 0	1299
<u>د</u> ر	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	215.0 0.40	_	ONS	- ( 115		•	•	•		۲,	74282 4	11941	å	116443
v) (	SUBTOTAL			-	15 % 15	15 %	%				ſ		6291	8	17466
-	CONTINGENCY											1	48232	3	133908
22	ADDIL COST (EQUIP) TO REPLACE (UPSIZE) COOLING TOWER													•	
C	COOLING TOWER - OPEN, AXIAL FAN	240.0	-	ONS 45	×	<u>.</u>	' ;	' 3	' ¢	. 75.5	, 44	10800	5 5	۸ د	425
, 0	CONCRETE FOUNDATION SUPPORT, 12"W x 36"H	o +			ר. ר.	. 0.3/	2 '	8	2 '	,		ì .	125	400	525
	CRANE, TRUCK MOUNTED, 12 TON	20 - 2					1.10	1.63		100.0	70.5	814	608	3 8	1685
u	PIPE, S.L., SCH 40, WELD, 6 FI BOW STI STD WGHT, WELD, 6"	4				10.20	5.5	19.5		0.0	70.5	361	433	3 8	710
	FLANGE, STL, 150 LB, WELD NECK, 6"	60 4					2 0	45		0.00	20.5	330	276	0	909
_	VALVE, IRON, BUTTERFLY, LUG, 6"					٠	1.10	1.50		102.4	67.8	220	66	0	319
	DISCONNECT SWITCH, NEMA 4, 460 V, 60 A (THHU 30 HP)						1.10	1.51		102.4	67.8	366	199	00	565
_ <	MOTOR CONNECTION W/ FLEX CONDUIT, 25 HP	- (	8.8	EA 5.70	25.50		0.10	1.50	1.10	102.4	67.8	20	3 79	. 0	126
_ '	WIRE, TYPE THWN, COPPER, STRANDED, #6 (THRU 30 HP)	20.05				•	1.10	1.50		102.4	67.8	<b>2</b>	136	0	ន្ត
	CONDUIT, HIGH GALY SIL, 3/4 (THAN 1749) DEMOLITION, COOLING TOWER/PIPING/STARTER/CONDUIT	215.0 1.00			· ·	- (2	•	•			۱.	13510	5799	283	19902
, 1	SUBTOTAL				15 % 15	% 15	*				1	2027	870	8	2986
3	CONTINGENCY											1553/	6000	780	55000
21002 22	ADDIL COST (PIPING) TO RELOCATE CHILLER													;	800
	PIPE STL SCH 40 WELD 6"		_		·	1.42	5.5			9 6	70.5	<u>12</u> 2	1214	8 4 7	2529 802
_	ELBOW, STL, STD WGHT, WELD, 6"		- •		•		1.10			0.00	70.5	149	. 6	0	389
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6" PIPF STI SCH 40 WELD, 6"	88	8 8	LF 18.50	17.60	1.42	0.1	1.63	0.10	100.0	70.5	122 180	1214	95 45	2529 802
	ELBOW, STL, STD WGHT, WELD, 6"						2					2951	3822	278	7051
	SUBTOTAL CONTINGENCY				15 % 11	15 % 15	*				1	3394	573 4395	320	8109
21002 22	TOTAL														

APPENDIX I

Table I-4. ECO-1 Calculation of Construction Cost

PLANT MASTER ITEM	ER ITEM	-1												
BLDG CHILLER	E	אומ אומ	Y LABOR UNIT	_	DNO.	UNIT		LAB	QP MIL	LAB	$\vdash$	1	EOP	TOTAL
ON		PER ADJUST	SI CIFFC	BARE	BARE	BARE	MARK	OH8P M	MARK COST		COST	COST	COST	COST
			FACTOR	<u> </u>	(TOT)	(F) (F)	5		JP ADJUST	T ADJUST	-			
		1-WAY		COST	COST	COST			(AUSTI	N) (AUSTIN	Ş			
27004 23	REPLACE CHILLER	HUN		\$/UNIT	\$/UNIT	\$/UNIT	%	%	% %	% %	5	8	*	69
	CHILLER - CENTRIFUGAL, WATER-COOLED	465.0	•											
	PIPE, STL, SCH 40, WELD, 8"	5	_			6	' ;				ര്	36270	-	134850
	ELBOW, STL, STD WGHT, WELD, 8"				450.00	1.76	0.7				919	203	33	1158
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 8"	-	2 1.00 E.	EA 495.00	50.50	16.90	5 5	5	1.10	70.5	•	22	26	1117
	FLANGE, STL, 150 LB, WELD NECK, 8"	60			90.50	7 30	2 5				_	12		1266
	VALVE, IRON, BUT LEHELY, LUG, 8" INSTIT EDEBOTASS AS LA ASSETTED.	-			141.00	3 '	100				25	200	<b>4</b> €	6 6 6 6
	PIDE STI SCHAO MEIO 8"	9			4.30	•	1.10					3 6		2 5
	ELBOW, STL. STD WGHT WFID A.	0 0			87.8	1.76	1.10				616	503		2 2
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED 8"	Ν •			159.00	12.80	1.10					22		1112
	FLANGE, STL, 150 LB, WELD NECK, 8"	- «			81.50		2				_	171		1266
	VALVE, IRON, BUTTERFLY, LUG, 8*	· -			90.50	7.30	1.10					620		1090
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	367			2 35	•	2.4				,	8		773
	MOTOH CONNECTION W/ FLEX CONDUIT, 200 HP	~			142.00		2 0				-	883		11730
	WINE, 1YPE THWN, COPPER, STRANDED, 250 MCM	20	8 1.00	2.35	1 07		2 5		10 102.4		356	578	0	934
	CONDUIT, HIGH GALV STL, 2-1/2"	20			6.10		2 5			67.9	1482	613	0 (	5082
	DEMOCITION, CHILLEH/PIPING/STARTER/CONDUIT	465.0 0.4	0.40 1.00 TON	- St	78)		·				200	869	0 0	1926
	CONTINGENCY										118262	- "	286	14508
27004 23	TOTAL			15 %	6 15%	15 %					17739		43	26551
28000 24	ł										136001	9	329	203561
(25 SIM)	_													
	CHILLER - CENTRIFUGAL, WATER-COOLED	119.0	1.00 TONS	IS 426 V	128 1/	ć								
	FIPE, SIL, SCH 40, WELD, 4"	9			11 00 11		, 4				50694	15232	0	65926
	FLECOW, SIL, SID WGHI, WELD, 4"	2	2 1.00 EA		81.50	10.25	1.0				202	9 6	8 4	494
	FLANGE ST: 150-19 WE'D NECK 4"	_			51.00		1.10				792	111	ů c	200
	VALVE_IRON_BUTTERFI_V TIGA 4**	ო -			41.00	5.10	1.10				158	286	2.5	478
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK 4"	- ç			81.50		1.10				202	175	0	377
	PIPE, STL, SCH 40, WELD, 6"	2 5			2.77		1.10				43	83	٥	106
	ELBOW, STL, STD WGHT, WELD, 6"	2 ~			17.60	1.42	9.1				407	405	3	843
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	-			00.72		0.7				180	277	45	805
	FLANGE, STL, 150 LB, WELD NECK, 6"	e			63.50	, 6	2 0				935	15	0	1086
	VALVE, IRON, BUTTERFLY, LUG, 6" START/DISCON MAKE DELTA OPEN MITHER DELTA	-		_	127.00		2 0				244	432	35	710
	MOTOR CONNECTION WAS EVEN OPEN, NEMA TYPE 1	110	1 1.00 HP		5.69	•	2 2	151	1.10	67.8	3587	2/6	0 0	3 26
	WIRE TYPE THWN COPPER STRANDED 1/0	- ;		ര	107.00		1.10	•			98	2.5	o c	286
	CONDUIT, RIGID GALV ST. 1-1/2"	2 6		1.14	0.65		1.10				360	184	0	544
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	11000	8.5	3.15	3.88		1.10	•			248	276	0	524
	SUBTOTAL		3		129)		•			•	٥	5676	٥	5676
28000 24 (25)	CONTINGENCY			15 %	15 %	15 %					58531	25341	219	84091
-											67311	29142	252	96705

Table I-4. ECO-1 Calculation of Construction Cost

	taria : Eco : calcalanol ol collon dollor															
PLANT	PLANT MASTER ITEM	ary Sts	OTY L		UNIT	LIND	LIND	EW.	PS.	EOP	ı	ΥB	ME	₽¥7	EQP	TOTAL
2	NO.		ADJUST DIFFIC	2110	HARE	BARE	BARE	WAP :	OH&P			-			COST	COST
)	2		4 EO 104	FACTOR	<u> </u>	( E	<u></u>	3		<u></u> م	ADJUST A	ADJUST				
		1-WAY			COST	COST	COST				(AUSTIN) (AUSTIN)	USTIN				
29005	26 REPLACE (DOWNSIZE) CHILLER	HON			\$WNIT	\$VNIT	SCNIT	*	*	*	%	%				*
	(27 SIM)															
	CHILLER - CENTRIFUGAL, WATER-COOLED	426.6	-	_	ONS 223 )(		0	•	•	٠	•	٠	95132	34981	o	130113
	PIPE, STL, SCH 40, WELD, 8"	9	8		88	22.00	1.76	5.5	1.62	1.10	100.0	70.5	616	503	36	1158
	ELBOW, STL, STD WGHT, WELD, 8"	2	2			159.00	12.80	1.10	1,61	1.10	1000	70.5	333	722	299	1117
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 8"	-	7			81.50	•	1.10	1.54	1.10	100	70.5	1089	12	30	1266
	FLANGE, STL, 150 LB, WELD NECK, 8"	က	7			90.50	7.30	1.10	1,62	1.10	100	70.5	422	620	. 84	1090
	VALVE, IRON, BUTTERFLY, LUG, 8"	-	2	_		141.00	٠	1.10	15.	1.10	100.0	70.5	473	300	9	773
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 8"	9	2			4.30	٠	1.10	1.60	1.10	100	70.5	69	6		9
	PIPE, STL, SCH 40, WELD, 8"	10	2			22.80	1.76	1.10	1.62	1.10	100.0	70.5	616	503	8	1158
	ELBOW, STL, STD WGHT, WELD, 8"	~	2		A 77.00	159.00	12.80	1.10	1.61	1.10	100	70.5	339	722	8 %	1117
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 8"	-	8			81.50	•	1.10	1.54	1.10	100.0	70.5	1089	171	3 0	1266
	FLANGE, STL, 150 LB, WELD NECK, 8"	6	8			90.50	7.30	1.10	1.62	1.10	100.0	70.5	422	620	8	1000
	VALVE, IRON, BUTTERFLY, LUG, 8"	-	8	1.00	`	141.00	٠	1.10	1.51	1.10	100.0	70.5	473	300	9 0	773
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	332	-		P 26.43	2.44	•	1.10	1.51	1.10	102.4	67.8	9884	829	0	10713
	MOTOR CONNECTION W/ FLEX CONDUIT, 200 HP	2	8			142.00	•	1.10	1.50	1.10	102.4	67.8	356	578	0	934
	WIRE, TYPE THWN, COPPER, STRANDED, 4/0	2	<b>a</b> 0	1.00	LF 2.00	0.97	٠	1.10	1.49	1.10	102.4	67.8	1262	549	0	1811
	CONDUIT, FIGUR GALV STL, 2	2	N	9.0	F 4.00	4.75	1	1.10	1.51	1.10	102.4	67.8	83	681	0	1312
	DEMOCITION, CHILLER/PIPING/STARTER/CONDUIT	474.0	0.40	1.00 TO	- SN	( 4	•	•	•	٠	•	•	0	14599	0	14599
	CONTINCENCY				!							ı	13205	56958	286	170449
20005	26 (27) TOTAL				15	% 15	% 15%					1	16981	8544	43	25568
26000													130186	65502	329	196017
	£															
	CHILLER - CENTRIFUGAL, WATER-COOLED	425.7	-	1 00 TONS	NS 223	108	,	•	4				0400	10070	•	0000
	PIPE, STL, SCH 40, WELD, 8"	5	. 01	100	28		17	1 10	8	1 10	ָ ס	, 20	4004	7064	9	22020
	ELBOW, STL, STD WGHT, WELD, 8"	8	8	1.00		159.00	12.80	1	19	9	100	20.0	330	2 2	3 %	1 2 2
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 8"	-	CΙ		EA 495.00	81.50	•	1.10	5.	1.0	100.0	70.5	1089	17	90	1266
	FLANGE, SIL, 150 LB, WELD NECK, 8"	၈	2			90.50	7.30	1.10	1.62	1.10	100.0	70.5	422	620	8	1090
	VALVE, IRON, BUTTERFLY, LUG, 8"	-	~		•	141.00	٠	1.10	1.51	1.10	100.0	70.5	473	300	0	773
	NOUL, FIBERGLAVO, ASJ, 1-172" LHK, 8"	9	7			4.30	•	1.10	1.60	1.10	100.0	70.5	85	97	0	159
	FIFE, S.L., SCH 40, WELL), 8-	£ (	8		F 28.00	22.00	1.76	1.10	1.62	1.10	100.0	70.5	616	503	33	1158
	CLECOW, SIL, SID WORL, WELD, O	N ·	2			159.00	12.80	1.10	1.61	1.10	100.0	70.5	338	722	99	1117
	FLEX COMM, I WIN-SHEDE NEOFICINE, FLANGEO, 8:	- (	N (			81.50		1.10	7	1.10	100.0	70.5	1089	177	0	1266
	VALVE 190N BUTTERE V 100 00		7			90.50	7.30		1.62	1.10	100	70.5	423	620	48	1090
	STABIONON WYF.DETA ODEN NEWA TVDE +	- 60	Ν.		W	141.00	•	2	1.5	9:10	100.0	70.5	473	300	0	773
	MOTOR CONNECTION W/FI FX CONDUCT 200 HP	150	- ٥		26.44	2.44	•	2.5	1.51	٠ <u>٠</u>	102.4	67.8	9858	827	0	10685
	WIRE, TYPE THWN, COPPER, STRANDED, 4/0	2 02	u a	8 8	200	142.00	•	2 5	5	2.5	102.4	87.8	326	578	0	934
	CONDUIT, RIGID GALV STL. 2"	2 2	9 6	3 5	8 6	4.75	•	2 5	. ·	2 9	102.4	8.79	1262	549	0 (	1811
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	400.0	0.40	1.00 TON	"	( 84 )	•	2 '	<u>.</u>	2 '	, a	0.70	3 6	13440	0	1312
	SUBTOTAL											-	1247R	55723	286	58987
	CONTINGENCY				15	% 15.9	% 15 %					•		8358	4	25348
36000	36000 30 (31) IOIAL											-	1	64081	329	194335

APPENDIX I

0	BLDG CHILLER NO NO	> ~ ~ _	ADJUST DIFFIC FACTOR ADJUST	IT UNIT BARE (TOT)	UNIT BARE (TOT)	BARE (TOT)	MARK P	MTL LAB EQP MARK OH&P MARK UP UP	7 A P	MTL 1 COST 0 ADJUST AD	LAB COST ADJUST	MTL COST (	COST	Sost	COST
00036	SO BEDIACE ALITICA	1-WAY RUN	FACI OH	COST SAUNIT	COST \$/UNIT	COST S/UNIT	%	*	(AU	(AUSTIN) (AUSTIN)	JSTIN)		•	•	•
	CHILLER - CENTRIFUGAL, WATER-COOLED PIPE STI, SCH 40 WEID 8"	425.7	1.00 TON	3, 223 )(	82 )(	0 0	, 5	, 6		' 6		94931	34907	0 8	129838
	ELBOW, STL, STD WGHT, WELD, 8"	2 00	8 8	7.00	159.00	~	2 2	1.67	20	0.00	70.5	339	2 Z	20	1117
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 8"	-	1.00	495.00	81.50		1.10	1.54		0.00		1089	177	0	1266
	FLANGE, STL, 130 LB, WELD NECK, 8" VALVE, IRON, BUTTERFLY, LUG, 8"	e -	2 1.00 EA	915.00	90.50	7.30	0.1	1.62	99	0.0		422	620	<b>\$</b>	96
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 8"	- 01	8 8	2.82	4.30		2 2	. 69.		900		62	36	0	159
	PIPE, STL, SCH 40, WELD, 8"	10	1.00	28.00	22.00		1.10	1.62		0.00		616	203	39	1158
	ELBOW, STL, STD WGHT, WELD, 8"  GLEY COMM TWIN SUEDE NEODERNE SLANDER OF	27		77.00	159.00	12.80	1.10	1.61		0.00		333	722	26	1117
	FLEA COMM, JWIN-SHENE NEOTHENE, FLANGED, 8"	- 0	8 8	495.00	81.50		2.5	4.5		0.0		1089	171	0 9	126
	VALVE, IRON, BUTTERFLY, LUG. 8"	n	3.8	215.00	141.00	ار ا	5 5	29.1	2 5	9 6		25	020	<b>4</b> ∞	1 28
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	331	1.00	26.44	2.44		1.10			02.4		9828	827	0	10685
	MOTOR CONNECTION W/ FLEX CONDUIT, 200 HP	8			142.00		1.10			02.4		356	578	0	93
	WINE, ITTE IHWN, COPPER, STRANDED, 4/0	2 8			0.97	•	9.			02.4		1262	549	0	1811
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	477.0	40 TON TON	(A	5/4		2.	٠.		02.4			14692	0 0	1312
	SUBTOTAL										-	12978	56975	286	170239
8	CONTINGENCY			15 %	15 %	15 %					1	- 1	8546	43	25536
36006	33 REPLACE CHILLER						١					- 1	65521	823	195775
	CHILLER - CENTRIFUGAL WATER-COOLED	975.0	TONG TONG		482	3						64.00	0.000	•	,
	PIPE, STL, SCH 40, WELD, 6*	10	2 8 1 2 2		17 60	140	, 6	, 8	٠ ټ	, e		407	405	, ,	20 g
	ELBOW, STL, STD WGHT, WELD, 6"	8			127.00	10.20	1.10		_	0.00	70.5	180	577	. 4	6 8
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	- (	8 5		68.00		1.10	-		100.0	70.5	935	151	0	1086
	VALVE IBON BUTTERFLY LIG 6*	n <del>-</del>	8 8		63.50	5.10	0.1	1.61	9.5	0.0	70.5	244	432	34	₹ 8
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	. <del>0</del>	8 8		3.52		10	-		9 8	70.5	200	80	0	5 6
	PIPE, STL, SCH 40, WELD, 6"	9	1.00		17.60	1.42	1.10			0.00	70.5	407	405	3.	8
	FLEOW, SIL, SID WGHI, WELU, 6" FLEX CONN TWIN-SHERE NEOPRENE FLANGED A"	N +	8 8		127.00	10.20	1.10			0.0	70.5	180	577	45	80
	FLANGE, STL, 150 LB, WELD NECK, 6"	- თ	2 1.00 EA	37.00	63.50	5.10	5 2	. 19	20	18.0	70.5	244	432	<b>⊃</b> ₹	2 2
	VALVE, IRON, BUTTERFLY, LUG, 6"	-;	1.0		127.00	•	1.10			0.00	70.5	330	276	0	9
	MOTOR CONNECTION W/FLEX CONDIT 250 HP	251	8 8		3.07	•	2.5	1.51		02.4	67.8	7800	789	0 0	8589
	WIRE, TYPE THWN, COPPER, STRANDED, 400 MCM	. 02			1.26		0		200	02.4	67.8	1183	366	0	15.49
	CONDUIT, RIGID GALV STL, 3*	_	1.00		8.55		1.10			02.4	67.8	678	621	0	1299
	SUBTOTAL	2/5.0 0.4	.40 1.00 ION	) ·	102)	1	•	•			٦	- 1	11220	0	11220
				15 %	15 %	15 %						12185	6780	8 8	18998
36006	33 ADDTL COST (EQUIP) TO RELOCATE PRIMARY CHILL WATER PUMP											1 1	51981	253	145654
		,	;												
	HELOCATION, FUMP ASSEMBLY SUBTOTAL	1.60	50 1.00 LOT		3000	300	•	1.65	1.10		70.5	٥	5584	228	6112
				15 %	15 %	15 %						9 0	838 4 88	82	917
36006	33 TOTAL 35 DEMOLISH ARANDONED CHILLER										1	٥	6422	209	7029
	DEMOLITION, CHILLEP/PIPING/STARTER/CONDUIT SUBTOTAL	48.0 0.40	40 1.25 TONS	) - S	134 )		•			•	.1	0	3216	0	3216
;				15 %	15 %	15 %					l	0	482	0	482
41005	35 IUIAL											٥	3698	0	3698

Table I-4. ECO-1 Calculation of Construction Cost

יי - יי																		
LANT SLDG (	PLANT MASTER BLDG CHILLER NO NO	PLANT MASTER ITEM BLOG CHILLER NO NO	PER ADJUS	ADJUST DIE	LABOR L	UNIT UNIT			UNIT	MARK	LAB EQP OH&P MAPK	EOP	MTL LAB COST COST	COST	MIL	LAB	EOP	TOTAL
	2			FACTOH AD	FACTOR	MEL SOST		(TOT) LAB COST	(TOT) EQP COST	<u>s</u> •	•	<u>* *</u>	ADJUST ADJUST (AUSTIN) (AUSTIN)	ADJUST (AUSTIN)		•	-	•
36014	32	ADDTL COST (EQUIP) TO DEMOLISH UNUSED COND WATER PUMP				5			I I		0	%	*	,	^	~	100	<u>م</u>
		DEMOLITION, PUMP/PIPING/STARTER/CONDUIT SUBTOTAL CONTINGENCY	-	0.40	8.	LOT		2000	200	•	1.65	1.10	•	70.5	000	931	88 8	
36014	38	TOTAL ADDIL COST (PIPING) TO DEMOLISH UNUSED CHILLER																1172
36014	38	DEMOLITION, PIPE, STL, SCH 40, WELD, 4* SUBTOTAL CONTINGENCY TOTAL	09	0.40	1.00	Į.	. 15 %	11.00	. 15 %	•	1.65		V. V	70.5	000	307	000	307
36014	36	REPLACE CHILLER													7	222		
36014 36014 36014	98 36	PIPE, STL, SCH 40, WELD, 4* ELBOW, STL, STD WGHT, WELD, 4* ELBOW, STL, STD WGHT, WELD, 4* FLAXGE, STL, 150 LB, WELD NECK, 4* FLAXGE, STL, 150 LB, WELD NECK, 4* INSUL, FIBERGLASS, ASJ, 1-10° THK, 4* PIPE, STL, SCH 40, WELD, 6* ELBOW, STL, STD WGHT, WELD, 4* FLEX CONI, YWIN-SHERE NEOPERE, FLANGED, 4* FLEX CONI, YWIN-SHERE NEOPERE, FLANGED, 4* FLEX CONI, YWIN-SHERE NEOPERE, FLANGED, 4* FLEX CONI, YWIN-SHERE NEOPERE, 5* FLEX CONI, YWIN-SHERE NEOPERE, 5* FLEX CONI, YWIN-SHERE NEOPERE, 5* FLEX CONI, YWIN-SHERE, Y LUG, 4* STARTOBISCON, WYF-GLETA, OPER, NEMA TYPE 1 MOTOR CONNECTION W FLEX CONDUIT, 25° FLEX CONICON, CHILLER-PIPING-STARTER-CONDUIT SUBTOTAL ADDIT, COST (EQUIP) TO RELOCATE COND WATER PUMP DEMOLITION, PUMPIPIPING-STARTER-CONDUIT SUBTOTAL ADDIT, COST (EQUIP) TO RELOCATE COND WATER PUMP DEMOLITION, PUMPIPIPING-STARTER-CONDUIT SUBTOTAL CONTINGENCY	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00	- 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	100 100 100 100 100 100 100 100 100 100	100NS 243 E F 715 E F 71715 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E F 726 E	= · · · · · · · · · · · · · · · · · · ·	7)( 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 11,00 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36014	96 96	ADDIL COSI (PIPING) TO RELOCATE CHILLER PIPE, STL, SCH 40, WELD, 4* ELBOW, STL, STD WGHT, WELD, 4* INSUL, FIBERGALSS, AS, 1-1/2" THK, 4* PIPE, STL, STD WGHT, WELD, 4* SUBTOTAL COANTINGENCY	8 4 8 5 4	20000	9.1.1.00.1.1	LF 9.45 EA 17.15 LF 1.95 LF 9.45 EA 17.15	%	11.00 81.50 17.7 11.00 81.50 15 %	1.38 10.25 1.38 10.25	55555	1.65 1.61 1.61 1.66 1.66	55555	100.0 100.0 100.0 100.0	70.5 70.5 70.5 70.5	416 151 86 208 151 1012		"	
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APPENDIX I

40 SIM    PEPLACE CHILLER   1935   15	40 SM  CHILER-CENTRFUGAL, WATER-COOLED   560.0   1 1.00 TONS   193   (40 SM)   11.00 TONS   11	March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   March   Marc
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FLANGE, STI., 150 IB, WELD NECK, 8	FLANGE, STI, 150 LB, WELD NECK, 8 - 100 LB, MILE INDIVIDENCE, 150 LB, WELD NECK, 8 - 100 LB, MILE NOT NECK, 150 LB, WELD NECK, 8 - 100 LB, MILE NOT NECK, 150 LB, WELD NECK, 8 - 100 LB, MILE NOT NECK, 150 LB, WELD NECK, 8 - 100 LB, MILE NOT NET THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THYN, COPPER, STRANDED, 350 MCM. THIS THAN NET THAN NET THAN NET THAN NET THAN NET THAN NET THAN NET THAN NE	FLANGE, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB, WELLD NECK, STL, 150 LB,
NANUL, FIGERGLASS, AS, L-1, THK, 8**   1	NAUL, FIGERIANS, SULTERPINION, BUTHERLY, LUG, 8"   1	NULL, FIGHCRIANS, ASL, 1-12°THK, 8°
PIPE, STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, WELD, 8"   LANGE STI, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 40, SCH 4	PIPE, STL, SCH 40, WELD, 8"   Laborated Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color of Color	PIPE STL, SCH 40, WELD, 8"   Language
FLEX CONV. ST., STO. WITH WIND STATE WED PRENE, FLANGED, 8" FLANGE, ST. FLANGE, ST. FLANGE, ST. FLANGE, ST. FLANGE, ST. FLANGE, ST., TO. E.A. 77.00 153.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 17.00 1	FLEX CONTINGENCY FLEX CONTINGENCY STATE STEP WIGHT (WELD B) FLEX CONTINGENCY STATE STEP WIGHT (WELD B) FLEX CONTINGENCY STATE STEP STEP STEP STEP STEP STEP STEP ST	FLEX CONVINCIANCE NET ALL STANDED, 8" FLANGED, 8" FLANGED, 8" FLANGED, 8" FLANGE, STALL STALLS WELD NET ALL
FLANGE, STI, 150 LB, WELD NECK, 87  FLANGE, STI, 150 LB, WELD NECK, 87  FLANGE, STI, 150 LB, WELD NECK, 87  FLANGE, STI, 150 LB, WELD NECK, 87  VALVE, IRON, BUTTERFLY, LUG, 8°  STATISCOAN, WATERFLY, LUG, 8°  STATISCOAN, WATERFLY, LUG, 8°  MOTOR CONNECTION W/FE THWN, COPPER, STRANDED, 350 MCM  CONDUIT, RIGID GALV, STI, 3°  SUBTOTAL  CONTINUENCY  CONTINUENCY  SOURTOR  CONTINUENCY  CONTINUENCY  SOURTOR  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONTINUENCY  CONT	FLANGE, STI, 150 LB WELD NECK, 8"  FLANGE, STI, 150 LB WELD NECK, 8"  FLANGE, STI, 150 LB WELD NECK, 8"  FLANGE, STI, 150 LB WELD NECK, 8"  FLANGE, STI, 150 LB WELD NECK, 8"  FLANGE, STI, 150 LB WELD NECK, 8"  STATIOBISCON, WITCHFLY, LUG, 8"  STATIOBISCON, WITCHFLY, LUG, 8"  MOTOR CONNECTION, CHILLEPPIPING/STARTER/CONDUIT, 250 HP  CONDUIT, RIGID GALV, STI, 3"  SOLO 0.40 1.00 TON A  SOLO 100 155 00 110 154 1.10 100.0 70.5 1089 177 0  AND TON A STATIOBISCON, WITCHFLY, LUG, 8"  SOLO 110 154 1.10 100.0 70.5 472 650 48  MOTOR CONNECTION, CHILLEPPIPING/STARTER/CONDUIT, 550 MCM  SOLO 110 150 1.10 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100.1 100	FLANGE, STL, 150 LB, WELD NEOPHENE, FLANGED, 8**  FLANGE, STL, 150 LB, WELD NEOPHENE, FLANGED, 8**  FLANGE, STL, 150 LB, WELD NEOPHENE, FLANGED, 8**  FLANGE, STL, 150 LB, WELD NEOPHENE, FLANGED, 8**  VALVE, ROW, BUTTERFLY, LUG, 8**  STATE, BOOK, BUTTERFLY, LUG, 8**  MOTOR CONNECTION WITE EXCONDUIT, 250 HP  WHE, TYPE THIWN, COPPER, STRANDED, 350 MCM  OCNDUIT, RIGID GALV, STL, 3**  DEMOLITION, CHILLEP/PIPINGSTARTER/CONDUIT  S60.0 0.40 1.00 TONS  15 % 15 % 15 % 15 % 15 % 15 % 15 % 15
VALVE, IRON, BUTTERFLY, LUG, 8' STATISTICAL WHITE PELVY, LUG, 8' STATISTICAL WHITE PELVY, LUG, 8' MOTATISTICAL WHITE PELVY, LUG, 8' MOTATISTICAL WHITE LATER CONDUIT, 250 HP CONDUIT, RIGID GALLY STT, 3' SUBTOTAL CONTILICAL WHITE PERVISON, WATER PERVISON WHITE TARK COPPER, STRANDED, 350 MCM SOURCETTON, WHITE LATER PERVISON WHITE TARK COPPER, STRANDED, 350 MCM TO 2 1.00 LF 3.15 1.19 1.10 1.50 1.10 102.4 67.8 1385 998 0 DEMOCHTION, CHILLE PUPINGSTARTER/CONDUIT 560.0 0.40 1.00 TONS  SUBTOTAL CONTINUE NO. 1.50 1.10 1.53 1.10 102.4 67.8 1365 1242 0 150 1.00 1.00 1.00 1.00 TONS  SUBTOTAL  SOURCE TOWN STRANDED, SEGMENT STRANDED, SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SEGMENT SE	VALVE, IRON, BUTTERFLY, LUG, 8° STATIOBICON, WITHER LY, LUG, 8° MOTATIOBICON, RESERVED LY, STANDED, 350 MCM  2 2 1.00 Hz 25.72 2.11 1.10 102.4 67.8 13385 938 0  CONDUIT, RIGID GALV, STI, 3° MOTATION, CHILLER/PIPING/STARTER/CONDUIT, 860.0 0.40 1.00 TONS  2 2 1.00 Hz 31.6 1.10 1.51 1.10 102.4 67.8 1385 938 0  CONTINGENCY  2 2 1.00 Hz 31.6 1.10 1.50 1.10 102.4 67.8 1385 938 0  CONTINGENCY  2 1.00 LF 8.60 8.55 1.10 1.50 1.10 102.4 67.8 1385 1242 0  1536 (40) TOTAL  15 % 15 % 15 % 15 % 15 % 15 % 15 %	VALVE, IRON, BUTTERFLY, LUG, 8' STARADISCON, WAYEDELI'A COPEN, PARTYPE1  462 1 1.00 EA 215.00 141.00 141.00 1.30 1.10 1.62 1.10 100.0 70.5 1089 177 0  MOTARCIONECTION WEEKEZ CONDUIT, 250 HP  WHE, TYPE THWN, COPPER, STRANDED, 350 MCM  WORL TYPE THWN, COPPER, STRANDED, 350 MCM  CONDUIT, RIGID GALV STL, 3'  EMOCLITION, CHILLEP/PIPING/STARTER/CONDUIT  S60.0 0.40 1.00 TONS  15 % 15 % 15 % 15 % 15 % 15 % 15 % 15
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	15 % 15 % 15 % 19 286	15 % 15 % 15 % 19 286 19692 9616 43

## **APPENDIX!**

												ŀ				LOTAL
PLANT MASTER ITEM	αīγ	1 ALD	LABOR	NI TING			TNO	MIL.		- è			MIL O		120	7 2
Ċ		DJUST C	FFIC	¥ E			A HE		OHST CHST CHST	MAHA	ADJUST AD	ADJUST				3
NO NO		FACTOR	CTOR				<u></u>	5				5				
	> >			COST \$AUNIT		COST C	COST	%	*	₹ *	(AUSTIN) (AUSTIN)	STIN)	•	•	•	••
41003 41 REPLACE CHILLER																
CHILLER - CENTRIFUGAL, WATER-COOLED	227.5	-	_		$\simeq$	$\simeq$	0	•	•	•			59833	25480	۰;	85313
PIPE, STL, SCH 40, WELD, 6"	2 6	~ ~					1.42	5 5	5 5	2 5	0.00	20.5		577	F 4	80 8 80 8
ELBOW, STL, STD WGHT, WELD, 6" FLEX CONN TWIN-SHEBE NEOPBENE FLANGED, 6"	7 -	N 64	8 8	EA 428	425.00 6	68.00	,	2 2	. 89	2 2	100.0	70.5		151	9 0	1086
FLANGE, STL, 150 LB, WELD NECK, 6"	6	8				3.50	5.10	1.10	1.61	10	100.0	70.5		432	34	710
VALVE, IRON, BUTTERFLY, LUG, 6"	-	8				2.00	•	9	1.54	9	100.0	20.5		276	0 (	909
INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	9 9	OI C				3.52	٠ ;	2.7	1.61	2 5	0.00	70.5		3 5	- F	130
PIPE, STL, SCH 40, WELD, 6"	2 "	N 6				8 6	3 5	5 5	3 4	2 5	3 5	70.5		3 5	¥	3 2
ELBOW, SIL, SID WGHI, WELD, 6" ELEY COMM TAKIN, SHERE NEODBENE ELANGED 6"	<b>~</b>	v 0				800	,	10	5.0	9	1000	20.5		151	9 0	1086
CLANOR ST. 450 D MED NECK A.	- 6	, 0				3.50	5.10	10	191	9	100	70.5		432	8	710
VALVE IBON BUTTERELY LUG 6"	. –	1 04				7.00		1.10	1.54	9	100.0	70.5		276	0	909
START/DISCON, WYE-DELTA, OPEN, NEWA TYPE 1	211	-				3.52	•	1.10	1.51	<u></u>	102.4	8.79		760	0	7505
MOTOR CONNECTION W/ FLEX CONDUIT, 250 HP	-	61				3.00		1.10	1.50	1.0	102.4	67.8		393	0	88
WIRE, TYPE THWN, COPPER, STRANDED, 300 MCM	20	4				1.12	٠	5	1.54	<u></u>	102.4	67.8		327	0	1210
CONDUIT, RIGID GALV STL, 2-1/2"	700	- 5	•		,	6.10		01.1	1.50	e '	102.4	8.79		1 0 0	<b>o</b> c	10102
DEMOCITION, CHILLER/PIPING/STANIER/CONDOL	6.122	5		5	-	7 1	,	,	•	,	,		72463	11348	200	114031
SOBIOIAL					15 %	15 %	15 %							6202	8	17104
												'	83332	47550	253	131135
41																
PIPE. STL. SCH 40, WELD, 6"	93	8	8.			7.60	1.42	1.10	5.63	1.10	100.0	70.5	1221	1214	94	2529
ELBOW, STL, STD WGHT, WELD, 6"	2	2	1.8			27.00	10.20	1.10	1.61	1.10	100.0	70.5	180	222	\$	805
INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	30	8	8			3.52	٠,	1.10	1.61	2.5	0.00	70.5	149	540	۰;	383
PIPE, STL, SCH 40, WELD, 6"	e .	cu c	8 8	= ÷	18.50	17.60	24.5	2 5	29.5	2 5	9.0	70.5	22.0	577	¥ 4	8 8
ELBOW, SIL, SID WGHI, WELD, 6"	7	4	3	_		3	0.50	2	5	2	3	2	2951	3822	278	7051
CONTINGENCY					15 %	15 %	15 %						443	573	45	1058
4													3394	4395	320	8109
42000 42 REPLACE (DOWNSIZE) CHILLER																
CHILLER - CENTRIFUGAL, WATER-COOLED	188.1	-	8	S	_	119 )(	0	•	•	•	•	•		22384	0	80507
PIPE, STL, SCH 40, WELD, 6"	10	8	8			7.60	1.42	1.10	1.63	9.1	100.0	70.5		405	3	843
ELBOW, STL, STD WGHT, WELD, 6"	61	01	8			27.00	10.20	5.5	1.61	9 9	100.0	70.5		277	φ Ω	802
FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	- 0	N C	8 8			3 5	, 6	2 5	5.0	2 5	9 6	20.5	244	432	, ¥	710
VAIVE IRON BUTTERFLY LUG 6"	. –	4 (4	8			27.00	·	2	1.54	0.7	100.0	70.5	330	276	0	909
INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	9	8	1.00			3.52	•	1.10	1.61	1.10	100.0	70.5	90	80	0	130
PIPE, STL, SCH 40, WELD, 6"	0	~	8			17.60	27.5	1.10	5.63	2.5	100.0	70.5	407	405	_ਦ	843
ELBOW, STL, STD WGHT, WELD, 6"	CV T	ou o	8.8			27.00	10.20	2 5	1.61	2 5	0.00	70.5	080	151	ů c	200
FLEX CONN, 1WIN-SHEHE NEOFHENE, FLANGED, 6"	- 6	N 0	3 8		37.00	32.50	5.10	2 0	. 6	2 2	28	20.5	244	432	3,4	35
VALVE IBON BUTTEREY - LG 6"	, ~	۱ ۵۷	8			27.00	'	1.0	1.54	1.10	100.0	70.5	330	276	0	9
START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	170	-	1.00			3.98	٠	1.10	1.51	1.10	102.4	67.8	5591	693	0	6284
MOTOR CONNECTION W/ FLEX CONDUIT, 200 HP	-	64	9.			12.00	•	1.10	1.50	9	102.4	67.8	178	289	0	467
WIRE, TYPE THWN, COPPER, STRANDED, 4/0	2 2	٠,	8.8			0.97	•	2.5	1.49	2 5	102.4	67.8	2 5	340	o c	0 4
CONDOLL, HIGHD GALV SILL, Z- DEMO: HIGH CHILLER/PIPING/STARTER/CONDUIT	209.0	0.40	3 8	SNO	_	116)			<u>.</u>	2 '	, 1	, '	90	9698	0	9696
SUBTOTAL												ı	69080	37440	82	106740
					15 %	15 %	15 %					1	10362	5616	8	16011
42000 42 TOTAL													79442	43056	253	122/51

**APPENDIX I** 

PLANT MASTER ITEM BLDG CHILLER NO NO	PLANT MASTER ITEM BLDG CHILLER NO NO	PER PER P	ADJUST DIFFIC FACTOR ADJUST FACTOR FACTOR	LABOR DIFFIC ADJUST	FINO	UNIT BARE (TOT)	UNIT BARE (TOT)	BARE (TOT)	MAPK PP	CAB X OH&P	EQP WARK UP	MIT. COST ADJUST	COST ADJUST	COST	COST	EQP COST	TOTAL
42000 42	ADDTL COST (PIPING) TO CORRECT PIPING DEFICIENCIES	27				COST	\$AUNIT	COST \$/UNIT	*	*	%	(AUSTIN) (AUSTIN)	(AUSTIN)	•	•	<b>"</b>	
	PIPE, STL, SCH 40, WELD, 6" ELBOW, STL, STD WGHT, WELD, 6"	5 %		9.8	LF.	18.50	17.60	1.42	1.1	•	0.1	100.0	70.5	407	405		
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6" PIPE, STL, SCH 40, WELD, 6"	166	1010	88	<u>"</u> "	2.25	3.52	. 54	5.5	2.5	2 2 2	9 6 6	70.5	8 6	80	<b>,</b> 0 %	130
	ELBOW, STL, STD WGHT, WELD, 6" SUBTOTAL SOUTHERN STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET STREET ST	CV.		1.00	Δ		127.00	10.20	1.1	•	1.10	100.0	70.5	1224	577	-	
42000 42 50001 43	CONTINGENCY TOTAL REPLACE CHILLER					15 %	15 %	\$	*					1408	2351		
	CHILLER - CENTRIFUGAL, WATER-COOLED	129.2	-	8	SNOT	3 402 )(	128 )(					•	•	51938	16538		6847
	ELBOW, STL, STD WGHT, WELD, 6"	2 8	N W	8 8		18.50 41.00	-	10.20	5.1		2 2	0.00	70.5	180			89 G
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6" FLANGE STI 150 IR WEID NECK 6"		000	8.5		425.00			7		1.0	100.0	70.5	935			108
	VALVE, IRON, BUTTERFLY, LUG, 6"	· -	N 62	8 8	ž á	37.00 150.00	127.00	5.10	5.1	1.5	2 2	0.00	70.5	330 24	432	¥ 0	710
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6" PIPE, STL, SCH 40, WELD, 6"	₽ ₽	00	8 8		2.25		, 5	1.10		5.5	100.0	70.5	S i			130
	ELBOW, STL, STD WGHT, WELD, 6"	2 64	4 (4)	8 8	Εď	41.00		10.20	1.1	•	5 5	0.00	70.5	180			8 8 4 9
	FLEX CONN, I WIN-SHEHE NEOPHENE, FLANGED, 6" FLANGE, STL, 150 LB, WELD NECK, 6"	<b>-</b> €	010	8 8		425.00		, 6	5.5		5.5	0.00	70.5	935			1080
	VALVE, IRON, BUTTERFLY, LUG, 6"	-	1 (1	1.00	Œ	150.00	127.00	·	1.10		2 2	1000	70.5	330			- 9
	STAHT/DISCON, WYE-DELIA, OPEN, NEMA TYPE 1 MOTOR CONNECTION W/ FLEX CONDUIT, 125 HP	117	<b>-</b> ∘	8 8	를 I	29.07	5.43	•	1.10		1.10	102.4	67.8	3831			448
	WIRE, TYPE THWN, COPPER, STRANDED, 2/0	07	1 4		5 🗠	1.32	0.74	٠,		_	1 2	102.4	67.8	418	218		28
	CONDUIT, RIGID GALV STL, 2" DEMO TION CHILLED/RIGHT BEED/COMPUTED	02			5	4.00	4.75	٠	1.10	•	1.10	102.4	67.8	315	340		95
	SUBTOTAL	129.2	0.40		SNO	•	94)	•			•	•	•	60810	4858		
50001 43	CONTINGENCY					15 %	15 %	. 15 %						9122	3987	3	- 1
50001 43	1													69932	30564	253	-
	COOLING TOWER - OPEN, AXIAL FAN	129.2	-	9.	TONS	20)(	9	•			•	•	•	6460	775	c	7236
	CONCRETE FOUNDATION SUPPORT, 12"W x 36"H CRANF TRUCK MOLINTED 12 TON	5 *	N 7	8.5		15.11	9.11	0.37	1.10	1.64	1.10	75.5	71.4	8	256	5	567
	PIPE, STL, SCH 40, WELD, 6"	- 8	- 8	8 8	_	18.50	17.60	1.42	1.10	. 69.	1.10	100.0	70.5	814	125 808	§ 8	525 168
	ELBOW, STL, STD WGHT, WELD, 6"	4	8	1.00		41.00	127.00	10.20	1.10		1.10	100.0	70.5	361	1153	8	1604
	FLANGE, STE, 150 LB, WELD NECK, 6" VALVE, IRON, BUTTERFLY, LUG, 6"	e	010	8 8	¥ Œ	37.00	63.50	5.10	5.5		1.10	100.0	70.5	244	432	8 0	7.8
	DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	. 64	-	0.0		115.00	69.00	•	1.0			102.4	67.8	259	140	0	36.6
	MOTOR STARTER, NEMA 1, 460 V, NEMA 0 (THRU 5 HP) MOTOR CONNECTION W/ FLEX CONDUIT 5 HP	000		8.8		145.00	93.00	•	1.1		1.10	102.4	67.8	327	189	0	516
	WIRE, TYPE THWN, COPPER, STRANDED, #14 (THRU 5 HP)	100	- 4	8 8		0.05	0.16	• •	5 6	1.48	5 5	102.4	67.8	∞ జ్ఞ	5 % 8 %	00	8 8
	CONDOTT, MIGID GALY STL, 1/2" (THRU 4-#10) DEMOLITION, CONDENSER/PIPING/STARTER/CONDUIT	- 3 - 3 - 3	2.00	8 8	TONS	1.20	2.37	• •	1.10	•	1.10	102.4	67.8	135	241	00	376
	SUBTOTAL CONTINGENCY					, \$1	, %	15 %						9262	5420	296	15278
50001 43	TOTAL							2					•	1990	5000	285	17550

# **APPENDIX!**

PLANT MASTER BLDG CHILLER NO NO	PLANT MASTER ITEM BLDG CHILLER NO NO	OTY PER CHIL	ADJUST FACTOR	DIFFIC	E S	UNIT BARE (TOT)	BARE (TOT)	BARE (TOT)	MARK O	E SE	MARK SPEC	COST ADJUST A	COST ADJUST	MTL	Sost	COST	TOTAL
50001	43 ADDTL COST (EQUIP) TO ADD CONDENSER WATER PUMP	1-WAY RUN		ACTOR		MTL. COST \$/UNIT	COST \$7UNIT		*	*	%	(AUSTIN) (AUSTIN)	(USTIN)	•	•	w	•
	PUMP, END SUCTION, 372 GPM @ 30', 7.5 HP	- \$	- 0	1.00	•	1600.00	255.00	•	1.10	1.53	1.10	100.0	70.5	1760	275	0	2035
	ELBOW, STL, STD WGHT, WELD, 6"	2 8	v 0	3 8		41 00	127.00	10.00	0.1		0 5	0.0	70.5	407	405	31	843
	REDUCER, STL, STD WGHT, WELD, 6"	-	8	00.1		32.50	127.00	10.20	1.10	9	1.0	9 9	70.5	2 2	288	8	382
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6" ELANGE STI 1501B WELD NECK 6"		C4 C	9.6		425.00	68.00	•	2	1.58	1.10	100.0	70.5	935	151	0	1086
	VALVE IRON BUTTERFLY LUG 6"	*	N 6	3 8		37.00	63.50	5.10	2.5	<u>.</u>	9.10	100.0	70.5	326	577	ð,	948
	VALVE, IRON, SILENT CHECK, FLANGED, 150 LB, 6"		- 1	8		530.00	127.00		100	4.5	2 0	9 6	20.0	9 8	130	0 0	23 60
	STRAINER, IRON, Y-TYPE, FLANGED, 125 LB, 6"	-	-	1.00		350.00	211.00	•	0	1.52	5	100	70.5	388	28	0	611
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6" DISCONNECT SWITCH NEMA 4 450 V 20 A CTUBIT 45 LID	5,	٧ ،	9.5		2.25	3.52	•	1.10	1.61	1.10	100.0	70.5	S	80	0	130
	MOTOR STARTER, NEMA 1, 460 V, NEMA 1 (THRU 10 HP)			8 8		115.00	69.00		9 9	1.50	5.5	102.4	67.8	8 5	25	0 (	500
	MOTOR CONNECTION W/ FLEX CONDUIT, 10 HP	-		8		3.55	26.50	•	0	151	10	102.4	67.8	8	2,5	<b>o</b> c	3 5
	WiRE, TYPE THWN, COPPER, STRANDED, #12 (THRU 7.5 HP)	8 8	4,	8.8	<u>u</u> :	0.07	0.19		9:	1.49	1.10	102.4	67.8	. 6	38	0	8
	SUBTOTAL	2	-	3		1.20	2.37		1.10	1.50	1.10	105.4	67.8	8	121	0	188
						15 %	15 %	15 %						815	508	143	1344
50001	43 TOTAL  43 ADDTI COST (DIDING) TO CHANGE EBON AID TO WATER COST (PD													6247	3897	164	10308
_																	
	PIPE, STL, SCH 40, WELD, 6"	5 ,	01 0	8.8	5	18.50	17.60	1.42	0.1	3.	1.10	100.0	70.5	407	405	9	843
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK 6"	2 5	N C	8 8	П — К п	2.00	127.00	10.20	2 5	5	5 5	9 9	70.5	8 2	577	45	805
	PIPE, STL, SCH 40, WELD, 6"	9	1 0	8	۳,	18.50	17.60	1.42	2 2	8	1 0	200	70.5	2442	2427	187	205
	ELBOW, STL, STD WGHT, WELD, 6"	9 9	٥,	8.5	E.	41.00	127.00	10.20	9.	19.	1.10	100.0	70.5	541	1730	135	2406
	SURTOTAL	2	5	3	5	•	00.11	•	•	1.65	•	•	70.5	۰	512	٥	512
	CONTINGENCY					15 %	15 %	15 %						2620	5731	98 9	9749
50001	43 TOTAL												'	4163	6591	458	11212
	44 HEPLACE (COMBINE/DOWNSIZE) CHILLEH(S)																
	CHILLER - CENTRIFUGAL, WATER-COOLED	306.0	-	•	ONS	241 )(	)( 86	6	٠	•	٠	•	٠	73746	29988	0	103734
	PIPE, STL, SCH 40, WELD, 6"	ō ,	N C	9.6	٤	18.50	17.60	1.42	1.10	8	1.10	100.0	70.5	407	405		843
	FLEX CONN. TWIN-SHERE NEODBENF FI ANGED 6"	v -	N 6	3 5		425.00	27.00	10.20	9	1.61	2.5	100.0	70.5	8 5	577		805
	FLANGE, STL, 150 LB, WELD NECK, 6"	- e	. 0	8 8		37.00	63.50	5.10	100	6.6	2 2	1000	20.5	244	151		1086
	VALVE, IRON, BUTTERFLY, LUG, 6"	_	8	1.00		150.00	127.00		1.10	5.	1.10	100.0	70.5	330	276		909
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6" PUPE STI SCH 40 WELD 6"	<del>2</del>	ο (	8.8		2.25	3.52		1.10	1.61	1.10	100.0	70.5	20	80		130
	ELBOW STIL STD WGHT WEID 6"	2 °	N 6	3 8		18.50	17.60	1.42	9.10	8 3	1.10	100.0	20.5	407	405		843
	FLEX CONN, TWIN-SHERE NEOPRENE, FLANGED, 6"	1	~ ~	8 8	` 5	425.00	68.00	10.20	2 2	5.58	2 2	0.00	70.5	935	151	က် ဝ	802 1086
	FLANGE, STL, 150 LB, WELD NECK, 6"	e .	2	1.00		37.00	63.50	5.10	1.10	1.61	1.10	100.0	70.5	244	432		710
	VALVE, IRON, BUTTERFLY, LUG, 6" STARTIONSON WARDETA ODEN NEWATVORA	- 200		8.8		150.00	127.00	•	1.10	1.54	1.10	100.0	70.5	330	276		909
	MOTOR CONNECTION W/ FLEX CONDUIT, 150 HP	2 2	- 2	3 8		47.00	119.00		0 0	2.5	5 5	102.4	67.8	213	790		8967
	WIRE, TYPE THWN, COPPER, STRANDED, 2/0	70	00	9.		1.32	0.74	•	1.10	1.5	1.10	102.4	67.8	833	124		1254
	CONDUIT, RIGID GALV STL, Z DEMOLITION CHILLER/PIPING/STARTER/COMPLIT	70	7 6	8.5		0.4	4.75		1.10	1.51	1.10	102.4	67.8	631	8		1312
	SUBTOTAL	200	Š	3	2	-	691		•		•	•	. '	0 87841	42526	1	6400
	CONTINGENCY					15 %	15 %	15 %						13176	6379	3 8	19588
20004	101AL				2								•	01017	49905		150175

APPENDIX I

n Cost
ition of Construction Co
of Cons
4. ECO-1 Calculation of
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ECO-
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PI ANT MACTED TICK	TED TED															
BLDG CHILLER NO NO	ILLER NO		ADJUST DI FACTOR AD	LABOR UI DIFFIC ADJUST FACTOR	UNIT UNIT BARE (TOT)	UNIT BARE (TOT)	BARE (TOT)	MARK PP	LAB OH&P A	EGP MTL MAPK COST UP ADJUST	L LAB ST COST JST ADJUST		MTL LAB		EQP TC	TOTAL
50004	44 ADAIL COCT ICALIN TO GER LOC CO.	1-WAY RUN	-	5	COST	COST	COST	•	è	(AUS	(AUSTIN) (AUSTIN)					
								•	•	7	,	4	2	•		
	PUMP, HOR SPLIT, 734 GPM @ 80', 25 HP	-	-		•	455 00	•	5								
	ELBOW, STL, STD WGHT, WELD, 6"	0,	N C			17.60	1.42	2 0							۶ ٥	3046
	REDUCER, STL, STD WGHT, WELD, 6" FLEX CONN TWINSHERS INCORDERING AND TWINSHERS INCORDER TO AND TRAINING	v	v 01	3.8 EA	A 41.00 A 32.50	127.00	10.20	5 5	1.61	1.10 100	100.0	70.5	180		45	805
	FLANGE, STL, 150 LB, WELD NECK, 6*		ο ο			68.00	'	1.10							8 0	382 1086
		• -	N CN			63.50	5.10	1.10							, <del>2</del>	948
	VALVE, INON, SILENI CHECK, FLANGED, 150 LB, 6" STRAINER, IRON V-TYPE FLANGED, 135 LB, 6"	-	-			127.00	• •	5 5							0 0	909
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	- 5	- 0			211.00	•	1.10							. 0	2 19
	DISCONNECT SWITCH, NEMA 4, 460 V, 60 A (THRU 30 HP)	: <del>-</del>	۰-			3.52		2 5							0	130
	MOTOR CONNECTION W/ FLEX CONDUIT 25 HP	₩,				194.00	•	1.1							0 0	319
	WIRE, TYPE THWN, COPPER, STRANDED, #6 (THRU 30 HP)	- 05	- 4			35.50	•	5.5							. 0	8 2
	CONDUIT, RIGID GALY STL, 3/4" (THRU 4-#6) DEMOLITION, PUMP/PIPING/STABITER/CONDUIT	20	-			2.67	٠.	- 1-					59		0 0	126
	PUMP, HOR SPLIT, 881 GPM @ 50', 20 HP		0.40		)T	2000	500	' ;							- 8	1019
	PIPE, STL, SCH 40, WELD, 6"	. p	- (1		-	17.60	1 42	5.5				•••			0	2942
	BEDUCER STI STO WORT WELD, 6"	83	α			127.00	10.20	0 0					407		31	843
	FLEX CONN, TWIN-SHERE NEOPRENE FLANGED 6"	<b>~</b> •	01 (			127.00	10.20	1.10					22		₹ 8	805
	FLANGE, STL, 150 LB, WELD NECK, 6"	- 4	N 0		425.00	68.00		1.10		10 100.0			35 1		30	362 1086
	VALVE, IRON, BUTTERFLY, LUG, 6"	-	1 01			127.00	5.10	1.10					26 5		45	948
	VALVE, IHON, SILENT CHECK, FLANGED, 150 LB, 6" STRAINER IDOM VINCE FILANCED, 150 LB, 6"	-	-			127.00		0.1					30		0	909
	INSUL, FIRERGLASS, ASJ, 1-10" THK 6"	-	-			211.00	•	0					83		0 0	22,
	DISCONNECT SWITCH, NEMA 4, 460 V, 60 A (THRL) 30 HPV	o •	٠,			3.52	•	1.10					205		<b>,</b>	130
	MOTOR STARTER, NEMA 1, 460 V, NEMA 2 (THRU 25 HP)					97.00		1.10	-				50		0	319
	MOTOH CONNECTION W/ FLEX CONDUIT, 25 HP	-	-			35.50		2.1					99		0	565
	CONDUIT, RIGID GALV STL. 3/4" ITHRU 4-#6)	S (2	4			0.33		2					و م		0 0	2 4 5
	DEMOLITION, PUMP/PIPING/STARTER/CONDUIT		- 5	_		2.67		1.10		,			13		. 0	8 8
	SOBIOTAL		2	•		0007	000	•		9	. 70		11	- 1	10	273
50004 44	- 1				15 %	15 %	15 %					19.0	13012 958	1438 4	25 25 26 26 26 26	23084
20004	ADDIL COST (PIPING) TO RELOCATE (COMB/DOWNSIZE) CHILLER(S)											149	54 110	11	57 26	547
	PIPE, STL, SCH 40, WELD, 6"				28.50	17.60	5	,								
	ELBOW, SIL, SID WGHT, WELD, 6* INSUL, FIBERGLASS, ASJ, 1-1/2" THK 6*				41.00	127.00	10.20									478
	PIPE, STL, SCH 40, WELD, 6"				2.25 18.50	3.52	, 5	1.10		1.10 100.0		5 322				841
	CEBOW, STE, STD WGHT, WELD, 6" DEMOLITION PIPE STT SON 40 WELD 4"		~		41.00	127.00	10.20									636
	DEMOLITION, PIPE, STL, SCH 40, WELD, 6"	200	<del>ද</del> ද	88		11.00	•		59.		70.5		0 1535		0 0	2406 1535
	CONTINGENCY	'	<u>:</u>		ı	00.71			2		. 70	9	ľ	- [	- 1	618
50004 44	TOTAL				15 %	15 %	15 %					806				717
50004 45 (46 SiM)	DEMOLISH CHILLER											692		Н	П	375
		125.0 0.4	0.40 1.	1.00 TONS		128 )		•								ş
5000A AE (46					15 %	, u							0 6400		6 6	6400
SUUU4 45 (46)	) IOIAL						% cl								1	8
													1			360

PLANI MASIEN IIEM BLDG CHILLER NO NO	ASI EH I I EM HILLER NO	유명된	ADJUST DIFFIC FACTOR ADJUST			BARE (TOT)	UNIT (TOT)	UNIT BARE (TOT)	MARK (	얆	MARK	MTL LAB COST COST ADJUST ADJUST		MIL L COST C	COST	COST	TOTAL COST
		1-WAY RUN		<b>L</b>	2 0 ₹			COST	*	>9	<u>s</u>	(AUSTIN) (AUSTIN)	STIN)	•			•
50004 4	45 ADDTL COST (EQUIP) TO DEMOLISH CHILL & COND WATER PUMPS (46 SIM)										1				,		,
2	DEMOLITION, PUMP/PIPING/STAFTER/CONDUIT DEMOLITION, PUMP/PIPING/STAFTER/CONDUIT		0.40	8.6	50		2000	200		1.65	5.5		70.5		931	88	1019
	SUBTOTAL	•			5		200	2	•	8	2		9	0	2007	2 8	1273
	CONTINGENCY 45 (46) TOTAL					15 %	15 %	15 %					I		314	30	34
87018 4	47 REPLACE CHILLER													۰	2408	228	2636
9		474.0	-		SNO	_	77 77	ĉ	•	•			3	99000	9079	•	
	PIPE, STL, SCH 40, WELD, 8"	5	8			_	22.00	1.76	1.10	1.62	1.10	100.0	, 70 , 70 , 70 , 70		969	9	1158
	ELBOW, STL, STD WGHT, WELD, 8"	~	8				29.00	12.80	1.10	1.61	2	100.0	0.5		222	8	117
	FLANGE, STL, 150 LB, WELD NECK, 8"	e	01 C	8.8	EA 49	495.00	81.50	. 00.	5.5	<u> </u>	2.5	100.0	50.0	680	177	0 ;	1266
	VALVE, IRON, BUTTERFLY, LUG, 8"	-	· 64				41.00	3 '	2 0	15.	2 2		20.0	7 5	8 8	Ď c	3 2
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 8"	₽:	8				4.30		1.10	9.	2		70.5	8	97	0	159
	FIFE, STL, SCH 4U, WELD, 8"	۰ ۵	8				22.00	1.76	1.10	1.62	1.10		70.5	616	503	39	1158
	FLEX CONN TWIN-SHERE NEODRENE FLANGED AT	N v	N C				59.00	12.80	9:10	1.61	٠ <u>.</u>		70.5		22	26	1117
	FLANGE, STL, 150 LB, WELD NECK, 8"	- en	4 0				90.50	7 30	5 5	¥. 8	2.5		70.5		17	0 9	1266
	VALVE, IRON, BUTTERFLY, LUG, 8"	-	1 01				41.00	3 '	2 2	1.51	2 0			473	300	å c	22.5
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	375	-				2.33	•	1.10	1.51	1.10				895	0	11962
	MOLORICANNECTION W/ FLEX CONDUIT, 200 RF WIRE TYPE THWN COPPER STRANDED 250 MOM	ω 5	C4 0				42.00		9.5	1.50	٠ <u>٠</u>				578	0	934
	CONDUIT, RIGID GALV STL, 2-1/2"	2 2	۰ ۵			6.30	7.0' 6 10	•	2 5	2 2	2 5		67.8	1482	613	0 0	2095
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	474.0	0.40	-	SNO		(2)		<u>?</u> '	<u>,</u>	· ·				869	0 0	14599
	SUBTOTAL												11	18968 5	58793	286	78047
87018 47	47 (48) TOTAL					15 %	15 %	15 %					=		8819	- 1	26707
													3	136813 6	6/612	828	204754
	CHILLER - RECIPROCATING, WATER-COOLED	121.8	-		SNO	7 617	128 7	ć		•			ě	70013	9	•	00.01
	PIPE, STL, SCH 40, WELD, 4"	9	8			<	<	1.38	1.10	1.65	01	100.0	. 6	-	250	ې د	70267
	ELBOW, STL, STD WGHT, WELD, 4"	CV	2				·	10.25	1.10	1.66	2	100.0	0.5	75	382	5	205
	FLEA COMM, INVIN-SHEME NEOFMENE, FLANGED, 4"	(	CV (				51.00	•	1.10	1.55	5.	100.0	0.5	792	111	0	903
	VALVE, IRON, BUTTERFLY, LUG, 4"	n <del>-</del>	N 6				91.00	5.10	5 5		2.5	•	5.0	158	286	중 '	478
	INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 4"	. <del>C</del>	. 0				277		2 5	2, 5	2 5		0 C	202	22	0 0	377
	PIPE, STL, SCH 40, WELD, 6"	5	N	9.1	<u>۔</u> اگا	18.50	17.60	1.42	5 2	. 8	2 2	100.0	0.5	\$ 40 404	5 S	ج ج	843
	ELBOW, SIL, SID WGHI, WELD, 6"	CV ·	2					0.50	1.10	1.61	÷.	100.0	0.5	180	577	45	802
	FLANGE, STL. 150 LB. WELD NECK, 6"	(*	010				68.00	, 5	5.5	1.58	2.5	100.0	0.5	935	151	0	1086
	VALVE, IRON, BUTTERFLY, LUG, 6"	· <del>-</del>	1 01				27.00	2 '	5 5	2	2 5	100.0	v .c	244	432		25
	START/DISCON, WYE-DELTA, OPEN, NEMA TYPE 1	112	-				5.62	٠	2	1.51	2 2			357	644	9 0	4304
	WIRE TYPE THWN COPPER STRANDED 1/0	- 5	α,				02.00		1.10	1.50	2			8	218		286
	CONDUIT, RIGID GALV STL, 1-1/2"	2 2	• -				0.65 8 8 8		2:	06.5	2 5		67.8	360	184		544
	DEMOLITION, CHILLER/PIPING/STARTER/CONDUIT	121.8	0.40	_		,	93)		•	3 '	٠		ó ,		664		5664
	SUBTOTAL												88	1	588		88748
91001	CONTINGENCY					15 %	15 %	15 %					8	- 1	4438	83	13312
	ł				i								5	00223	34006		02060

**APPENDIX I** 

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Iani	1	able 1-4. ECO-1 Calculation of Construction Cost																	
PLANT MASTER BLDG CHILLER	MASTE	PLANT MASTER ITEM BLDG CHILLER	OTY OTY PFR ADJUST		LABOR (	TINC		UNIT	1	MARK	8 2	EOP	MTL	LAB	MIL	LAB	EGP	TOTAL	
O _N	0 N		_	OR AD	ADJUST		(E)	Top	(TOT)	d d	1		-				3	3	
			or 1-WAY	¥¥	5			Sost	COST				(AUSTIN) (AUSTIN)	(NSTIN)					
91001	67	APDTI COST (FOLIDE) TO APD COOL ING TOWER	RUN			\ <u>\$</u>		TINO!	\$/UNIT	*	%	*	%	%	<b>~</b>	\$		~	
	?																		
		COOLING TOWER - OPEN, AXIAL FAN	121.8	-	_		23)(	9		•	•	•	•	•	6455	731	0	7186	
		CONCHETE FOUNDATION SUPPORT, 12"W×36"H	5 +	~	8 8	- E	15.11	9.1	0.37	1.10	<del>2</del>	<del>-</del> 2	75.5	71.4	301	256	2 5	567	
		PIPE STL SCH 40 WELD 6*	- 6	- 0				17.60	, 67	, č	. 64	, 5	, 6	. 402	, ,	22.0	3 2	222	
		ELBOW, STL, STD WGHT, WELD, 6"	3 4	۱ ۵				27.00	10.20		3 5	2 5	200	70.5	36.	1153	8 8	1604	
		FLANGE, STL, 150 LB, WELD NECK, 6"	ღ	2				63.50	5.10	1.10	1.61	1.10	100.0	70.5	244	432	8	710	
		VALVE, IRON, BUTTERFLY, LUG, 6"	-	2				127.00	•	1.10	1.54	1.10	100.0	70.5	330	276	0	909	
		DISCONNECT SWITCH, NEMA 4, 460 V, 30 A (THRU 15 HP)	<b>6</b> 1 (	_		•		69.00		1.10	1.50	1.10	102.4	67.8	259	140	0	333	
		MOTOR CONNECTON W/ FLEX CONDIST A DE	CV C				45.00	93.00	٠	9.7	1.50	5.5	102.4	67.8	327	189	0 (	516	
		WIRE TYPE THWN COPPER STRANDED #14 (THRUS HP)	v 5					26.50	•	0.7		5.5	102.4	67.8	æ 8	45	0 0	8 8	
		CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	9 0	۰-				2.37		0.0	5 65	2 0	102.4	67.8	135	241	0	376	
		DEMOLITION, COOLING TOWER/PIPING/STARTER/CONDUIT	121.8 1.	00.1	-	ONS	•	9	•	•	•	•	•	•	0	731	0	731	
		SUBTOTAL												l	9257	5203	969	15056	
91001	49	TOTAL					% 61	, cl	% cL					1	1389	780	88	2258	
91001	49	1														3	3		
		PUMP, END SUCTION, 351 GPM @ 30', 7.5 HP	-	-	0.1	-		255.00	•	1.10	1.53	1.10	100.0	70.5	1760	275	0	2035	
		PIPE, STL, SCH 40, WELD, 6"	10	~	8			17.60	1.42	1.10	1.63	1.10	100.0	70.5	407	405	3	843	
		ELBOW, STL, STD WGHT, WELD, 6"	7	0	00.			127.00	10.20	1.10	1.61	1.10	100.0	70.5	180	277	45	805	
		REDUCER, OIL, OID WGHI, WELD, 6"	- ,	N C	9.6			27.00	10.20	0.1	1.61	1.10	100.0	70.5	72	288	ß	382	
		FLEA COUNTY, LYNIN-SHENE NEOPTIENE, FLANGEL, 6" ELANGE STI 15018 MELD NEOK 6"		N C	8 6			68.00		0.1	1.58	1.10	100.0	70.5	935	151	0 ;	1086	
		VA: VE IRON RUTTERFY VIII 6"	<del>.</del>	N 6	3 5			63.50	5.10	0.1	9.1	0.1	0.00	70.5	326	577	<del>ئ</del> د	948	
		VALVE, IRON, SILENT CHECK, FLANGED, 150 LB, 6"		٠.	8 8			27.00		2 5		2 5	2.5	70.5	583	130	0 0	2 6	
		STRAINER, IRON, Y-TYPE, FLANGED, 125 LB, 6"	-	-	8			1.00		1.10	1.52	0	100.0	70.5	385	28	0	1 19	
		INSUL, FIBERGLASS, ASJ, 1-1/2" THK, 6"	10	2	9.1	5	2.25	3.52		1.10	1.61	1.10	100.0	70.5	20	80	0	130	
		MOTOR STABLED MEMA 4 460 V, 30 A (THRU 15 HP)	- •	<b>-</b> ,	8.8			69.00	•	0.1	1.50	01.1	102.4	67.8	130	2	0	8	
		MOTOR CONNECTION W/ FLEX CONDUIT, 19 HP			3 8			24.00		5 5	2.5	01.1	102.4	67.8	186	138	0 0	324	
		WIRE, TYPE THWN, COPPER, STRANDED, #12 (THRU 7.5 HP)	- 20	4	8			0.19		9	64.	100	102.4	67.8	16	3 6	0	5 KS	
		CONDUIT, RIGID GALV STL, 1/2" (THRU 4-#10)	20	_	8			2.37		1.10	1.50	1.10	102.4	67.8	68	121	0	189	
		CONTINGENCY					45 %	15 %	15 %						5432 815	3389	5 5	1344	
91001	6	TOTAL							2					1	6247	3897	1 20	10308	
91001	49	ADDTL COST (PIPING) TO CHÂNGE FROM AIR- TO WATER-COÖLED																	
		PIPE, STL, SCH 40, WELD, 4"	8 r	011				11.00	1.38	1.10	1.65	1.10	100.0	70.5	624	768	6	1483	
		ELBOW, STL, STD WGHT, WELD, 4" INSUL, FIBERGLASS, ASJ, 1-12" THK 4"	a 0	N 6		•		91.50	10.25	<del>-</del> -	99.	2 5	100.0	70.5	189	954	£ 0	1256	
		PIPE, STL, SCH 40, WELD, 6"	88	10	8	تا:	18.50	17.60	1.42	1.0	8	2 2	100.0	70.5	2646	2629	203	5478	
		ELBOW, SIL, SID WGRI, WELD, 6" SUBTOTAL	12	2		•	-	27.00	10.20	1.10	9.	1.10	100.0	70.5	1082	3460	569	4811	
	:	CONTINGENCY					15 %	15 %	15 %						25	1200	10.5	2002	
91001	£	TOTAL		1										'   	5371	9200	111	15348	

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	UNIT	COST ADJUST (AUSTIN)	QTY	TOTAL
121	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	198	1260
		EXCAVATION & BACKFILL	SF	1.59	0.884	198	278
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	198	1055
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	30	58
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	198	760
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.938	198	543
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	598	4773
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	198	525
		INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	ō	0
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	289
		DUCT DAMPER, 24x16	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	110	586
		REVISE DUCTWORK	LB	6.10	0.874	172	917
		RELOCATE LOUVER	SF	16	0.874	25	350
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	622
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	198	405
				CONTING	ENCY		17300
COMMENT	· ·			TOTAL			20760

1. REFRIGERANT = 850# OF R-11 / MECH ROOM @ GROUND LEVEL
2. CHILLER IN ROOM WITH GAS WATER HEATERS AND AIR-HANDLING UNIT
3. VERY DIFFICULT TO SOLATE THE CHILLER
4. RECOMMEND EXTENDING MECH ROOM 9'X 31' AND LEAVING PUMPS IN PRESENT LOCATION

135	1	FOUNDATIONS					
133	'	FOUNDATIONS FOUNDATION & FOOTINGS	SF	7.20		_	
		EXCAVATION & BACKFILL	SF		0.884	0	0
		EXCAVATION & BACKFILL	51	1.59	0.884	0	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	ō
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	ō	ŏ
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	ō
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ŏ	ŏ
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.38	0.789	0	0
	8	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	1	972
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	235	794
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	269
		DUCT DAMPER, 24x16	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	110	586
		REVISE DUCTWORK	LB	6.10	0.874		0
		RELOCATE LOUVER	SF	16	0.874	ŏ	ő
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	i	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	622
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	ō	0
							6198
				CONTINGE	4CY		1.20
COMMENTS:				TOTAL			7438

REFRIGERANT = 405# OF R-12 & 400# OF R-22 / MECH ROOM IN BASEMENT
 TWO CHILLERS IN ROOM WITH GAS WATER HEATERS AND AIR-HANDLING UNIT
 ARRLY SMPLE TO ISOLATE THE CHILLERS, ESPECIALLY WHEN THE TWO WILL BE REPLACED WITH
 A SINGLE CHILLER ALSO CONSIDER PICK UP LOAD OF AIR-COOLED UNIT AT OTHER END OF BLDG.
 ALSO REPLACE TWO COOLING TOWERS WITH ONE

PLANT ITEM DESCRIPTION

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

UNIT UNIT COST QTY

TOTAL

NO NO	IIEM	DESCRIPTION	UNII	COST	ADJUST (AUSTIN)	QIY	COST
14	1	FOUNDATIONS	SF				
		FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF	7.20 1.59	0.884 0.884	0	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD	SF SF	6.03 2.19	0.884 0.884	0	0
	3	SUPERSTRUCTURE					
	•	STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF	4.10 2.93	0,938 0,938	0	0
			•		0.000		•
	4	EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	8	INTERIOR					
	•	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD	EA SF	1059 4.13	0.918 0.818	2 574	1944 1939
	_						
	7	MECHANICAL VENTILATION EXHAUST FAN, WALL MOUNTED PROP	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	ò	1311
		DUCT DAMPER, 24x18	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	288	1535
		REVISE DUCTWORK RELOCATE LOUVER	LB SF	6.10 18	0.874 0.874	0	0
			0,		0.074	•	•
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	ĒÃ	65	0.874	i	57
		REFRIGERATION SENSORVALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL				_	
		WIRE & CONDUIT, 1/2 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	EA EA	790 147	0.787 0.787	1 2	622 231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	ő	0
							8995
IMEN	T9-			TOTAL	SENCY		1.20
,	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF SF	7.20 1.59	0.884 0.884	0	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD	SF SF	6.03 2.19	0.884 0.884	0	0
			<b>O</b> 1	2.10	4.004	٠	•
	3	SUPERSTRUCTURE STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ő	ŏ
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	a
	5	ROOFING TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6						
	•	INTERIOR					
		NTERIOR HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
			EA SF	1059 4.13	0.918 0.818	2 240	
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION	SF	4.13	0.818	240	811
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL	SF EA	4.13 1500	0.818	240	1311
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	SF	4.13	0.818 0.874 0.874	240 1 9.3	1311
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24x18 DUCT DAMPER	SF EA SF	4.13 1500 41 93 6.10	0.818	240	1311 333 81 640
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24x18	SF EA SF EA	4.13 1500 41 93	0.818 0.874 0.874 0.874	1 9.3 1	1311 333 81 640 1439
		HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24418 DUCT DAMPER, 24418 PUCTWORK REVISE DUCTWORK RELOCATE LOUVER	SF EA SF EA LB LB	4.13 1500 41 93 6.10 6.10	0.818 0.874 0.874 0.874 0.874 0.874	240 1 9.3 1 120 270	1311 333 81 640 1439
	7	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24x18 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER CONTROLS	SF SF SA LB LB SF	4.13 1500 41 93 6.10 6.10	0.818 0.874 0.874 0.874 0.874 0.874	1 9.3 1 120 270 16	1311 333 81 640 1439 224
		HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24418 DUCT DAMPER, 24418 PUCTWORK REVISE DUCTWORK RELOCATE LOUVER	SF EA SF EA LB LB	4.13 1500 41 93 6.10 6.10	0.818 0.874 0.874 0.874 0.874 0.874	240 1 9.3 1 120 270	1311 1333 81 640 1439 224 226 57
	•	HOLLOW METAL DOOR, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DOMPER, 24x18 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSORVALARM	SF EA SF EA LB SF	4.13 1500 41 93 6.10 6.10 16	0.818 0.874 0.874 0.874 0.874 0.874 0.874	240 1 9.3 1 120 270 16	1311 1333 81 640 1439 224 226 57
		HOLLOW METAL DOOR, 1-HR, PTD  PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER  DUCT DAMPER, 24x18 DUCTWORK RELOCATE LOUVER  CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSORVALARM  ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR	SF ASSABLISF BABA	4.13 1500 41 93 6.10 6.10 16	0.818 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874	240 1 9.3 1 120 270 16	311 1311 333 81 640 1439 224 228 57 1049
	•	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 2418 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SF EASTER SEA EA	4.13 1500 41 93 6.10 6.10 16 259 65 1200	0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874	1 9.3 1 120 270 16 1 1 1 1 1 1 1 1 2 2 1 1 1 2 1 1 2 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	311 333 81 840 1439 224 228 57 1049
	•	HOLLOW METAL DOOR, 1-HR, PTD  PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER  DUCT DAMPER, 24x18 DUCTWORK RELOCATE LOUVER  CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSORVALARM  ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR	SF ASSABLISF BABA	4.13 1500 41 93 6.10 6.10 16 259 65 1200	0.818 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874	240 1 9.3 1 120 270 16	1944 811 1311 333 81 640 1439 224 228 57 1049 822 231 0
	•	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 2418 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SF EASTER SEA EA	4.13 1500 41 93 6.10 6.10 16 259 65 1200	0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.787 0.787	1 9.3 1 120 270 16 1 1 1 1 1 1 1 1 2 2 1 1 1 2 1 1 2 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	311 333 81 840 1439 224 228 57 1049
MAMEN	8	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 2418 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SF EASTER SEA EA	4.13 1500 41 93 6.10 6.10 16 259 65 1200 790 147 2.60	0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.874 0.787 0.787	1 9.3 1 120 270 16 1 1 1 1 1 1 1 1 2 2 1 1 1 2 1 1 2 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	311 333 81 844 1433 224 226 55 1044 822 231

REFRIGERANT - 1214# OF R-12 / MECH ROOM BELOW GRADE
 TWO CHILLERS IN ROOM WITH GAS-FIRED BOILER AND WATER HEATERS
 VERY EASY TO ISOLATE THE CHILLER
 WATCH TUBE-PULL CLEARANCES AND WALL/FLUE HEADER CONFLICTS

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST (AUSTIN)	QTY	COST
2805	1	FOUNDATIONS			1.100.00		
		FOUNDATION & FOOTINGS	SF	7.20	0.884	160	1018
		EXCAVATION & BACKFILL	SF	1.59	0.884	160	225
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	160	853
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	42	81
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	160	614
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.938	160	439
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	218	1740
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.38	0.789	160	424
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	150	507
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1025	0.874	1	896
		INTAKE LOUVER	SF	41	0.874	5.5	197
		DUCT DAMPER, 20x16	EA	77	0.874	1	67
		DUCTWORK	LB	6.10	0.874	100	533
		REVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	16	0.874	0	0
		CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	228
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/3 HP FAN MOTOR	EA	775	0.787	1	610
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	160	12038
				CONTING	ENCV		1.2038
COMMENT	ne.			TOTAL			14448

^{1.} REFRIGERANT = 415# OF R-113 / MECH ROOM @ GROUND LEVEL
2. CHILLER IN ROOM WITH GAS-FIRED BOILER AND AIR-HANDLING UNIT
3. FAIRLY SIMPLE TO ISOLATE THE CHILLER
4. RECOMMEND EXTENDING MECH ROOM 10' AND MOVING DOUBLE DOORS TO ALLOW TUBE PULL

5764	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0 884	ō	
		EXCAVATION & BACKFILL	SF	1.59	0.884	ŏ	õ
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	ō	č
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ō	i
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	(
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	(
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	1	977
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	267	902
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1025	0.874	1	896
		INTAKE LOUVER	SF	41	0.874	5.5	19
		DUCT DAMPER, 20x16	EA	77	0.874	1	67
		DUCTWORK	LB	6.10	0.874	100	53
		REVISE DUCTWORK	LB	6,10	0.874	0	
		RELOCATE LOUVER	SF	18	0.874	ō	i
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	104
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/3 HP FAN MOTOR	EA	775	0.787	1	610
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	23
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0 .	
							5740
.armerma				CONTINGE	NCY		1.20
COMMENTS	5:			TOTAL			6888

REFRIGERANT = 485# OF R-113 / MECH ROOM IN BASEMENT
 CHILLER IN ROOM WITH GAS-FIRED BOILER AND WATER HEATERS
 FAIRLY SIMPLE TO ISOLATE THE CHILLER
 ALSO PICKUP LOAD FROM AN OUTDOOR AIR COOLED CHILLER WHEN MAIN CHILLER IS REPLACED.

TOTAL

#### APPENDIX I

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

ANT LDG WD	ITEM	DESCRIPTION	UNIT	UNIT	COST	QTY	TOTAL
12	1	FOUNDATIONS			(AUSTIN)		
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	
		EXCAVATION & BACKFILL	SF	1.59	0.884	ŏ	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	Ö	0
	3	SUPERSTRUCTURE				•	
	•	STEEL FRAMING	SF	4.44			
		ROOF, OPEN WEB JOIST, STL DECK	SF	4.10 2.93	0.936 0.936	0	0
	4				0.200	٠	0
	•	EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD					
			SF	9.83	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	8	NTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	_	
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	102	1944 345
	7	MECHANICAL VENTILATION					343
	,	EXHAUST FAN, ROOF CENTRIFUGAL					
		INTAKE LOUVER	EA SF	1025 41	0.874	- 1	896
		DUCT DAMPER, 20x16	ĔĂ	77	0.874 0.874	5.5 1	197 57
		DUCTWORK BEVIEW DUCTWORK	LB	6.10	0.874	100	533
		REVISE DUCTWORK RELOCATE LOUVER	LB SF	6.10	0.874	0	0
			55	16	0.874	0	Ģ
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH	EA	259	0.874	1	226
		REFRIGERATION SENSOR/ALARM	EA	65	0.874	1	57
			EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	EA	775	0.787	1	610
		LIGHTS & RECEPTACLES	EA SF	147 2.80	0.787	2	231
			3r	2.00	0.787	۰.	6155
NTS							
IILLE	ERANT	= 485# OF R-113 / MECH ROOM IN BASEMENT IOM WITH GAS-FIRED BOILER		CONTINGE	ekcy .		7386
HILLE	BERANT R IN RO LASY TO	IOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER			ENCY		
ILLE	ERANT	IOM WITH GAS-FIRED BOILER ISOLATE THE CHILLER FOUNDATIONS		TOTAL			
ЦE	BERANT R IN RO LASY TO	OM WITH GAS-FIRED BOILER DISOLATE THE CHILLER FOUNDATIONS FOUNDATION & FOOTINGS	SF	7.20	0.884	0	7386
ЩE	GERANT R IN RO LASY TO	IOM WITH GAS-FIRED BOILER I SOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF SF	TOTAL		0	7386
ILLE	BERANT R IN RO LASY TO	OM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE	SF	7.20 1.59	0.884		7386
ЩE	GERANT R IN RO LASY TO	FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6° SLAB ON GRADE, GRAY, VAP BAR	SF SF	7.20 1.59 6.03	0.884 0.884	0	7386
ЩE	BERANT R IN RO ASY TO	OM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD	SF	7.20 1.59	0.884 0.884	0	7386
ЦE	GERANT R IN RO LASY TO	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD SUPERSTRUCTURE	SF SF SF	7.20 1.59 6.03	0.884 0.884	0	7386
ЩE	BERANT R IN RO ASY TO	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD SUPERSTRUCTURE SUPERSTRUCTURE STEEL FRAMING	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	7386
ШE	BERANT R IN RO LASY TO 1 2	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	7386
ШE	BERANT R IN RO ASY TO	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	0 0
ILLE	BERANT R IN RO LASY TO 1 2	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	0 0
ШE	BERANT R IN RO LASY TO 1 2	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE	SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.836 0.936	0 0	0 0 0 0 0
ЦE	BERANT R IN RC ASY TO	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.834 0.936 0.936	0 0 0	0 0 0 0 0
IILLE	I I I I I I I I I I I I I I I I I I I	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD ROOFING TAR & GRAVEL W/ INSULATION	SF SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.836 0.936	0 0	0 0 0 0 0
ILLE	BERANT R IN RC ASY TO	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83	0.884 0.884 0.884 0.836 0.936 0.812	0 0 0 0 0 0 0 0 0	7386
ILLE	I I I I I I I I I I I I I I I I I I I	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD ROOFING TAR & GRAVEL W/ INSULATION	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.884 0.936 0.936 0.936	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 1944
TLLE	RIN RG 1 2 3 4 5	FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR  NITERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83	0.884 0.884 0.884 0.836 0.936 0.812	0 0 0 0 0 0 0 0 0	7386
TLLE	RIN RG 1 2 3 4 5	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION	SF SF SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.836 0.936 0.936 0.812 0.789	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 1944
ILLE	RIN RG 1 2 3 4 5	COM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W. INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13	0.884 0.884 0.884 0.836 0.936 0.936 0.912 0.789 0.918 0.812	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1	7386 0 0 0 0 0 0 0 0 1944 1488
ILLE	RIN RG 1 2 3 4 5	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W; INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	SF SF SF SF SF SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.836 0.936 0.936 0.812 0.789	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7386 0 0 0 0 0 0 0 1944 1466
4ILLE	RIN RG 1 2 3 4 5	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCTYORK	SF SF SF SF SF SF SF SF SF SF SF SF SF S	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 168 6.10	0.884 0.884 0.834 0.936 0.936 0.936 0.812 0.789 0.918 0.818	0 0 0 0 0 0 0 0 2 434 1 9.3 1 142	7386 0 0 0 0 0 0 1944 1485 1311 333 143 757
IILLE	RIN RG 1 2 3 4 5	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W; INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	SF SF SF AF AFABBB	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 168 6.10	0.884 0.884 0.884 0.836 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 2 434 4 1 9.3 1 142	7386 0 0 0 0 0 0 1944 1455 1311 1333 143 757 0
IILLE	EERANTI RIN RCAASY TO	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 36X16 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER	SF SF SF SF SF SF SF SF SF SF SF SF SF S	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 168 6.10	0.884 0.884 0.834 0.936 0.936 0.936 0.812 0.789 0.918 0.818	0 0 0 0 0 0 0 0 2 434 1 9.3 1 142	7386 0 0 0 0 0 0 1944 1485 1311 333 143 757
ILLE	EERANTI RIN RCAASY TO	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR MOCHANICAL VENTILATION EXHAUST FAIR ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 36X16 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER CONTROLS	SF SF SF SF SF SF SF SF SF SF SF SF SF S	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10	0.884 0.884 0.884 0.834 0.938 0.938 0.938 0.938 0.938 0.938 0.938 0.812	0 0 0 0 0 0 0 0 2 434 4 1 9.3 1 142	7386 0 0 0 0 0 0 1944 1455 1311 1333 143 757 0
ЦE	EERANTI RIN RCAASY TO	COMMITTH GAS-FIRED BOLLER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W, INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 36x16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120Y-1PH	SF SFS SF SF SF SF SF SF SF SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10 18	0.884 0.884 0.834 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 2 434 1 1,142 0 0	7386 0 0 0 0 0 0 1944 1465 1311 333 145 757 0
1E	EERANTI RIN RCAASY TO	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR MOCHANICAL VENTILATION EXHAUST FAIR ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 36X16 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER CONTROLS	SF SF SF SF SF SF SF SF SF SF SF SF SF S	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10 6.10	0.884 0.884 0.884 0.894 0.938 0.938 0.938 0.918 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 2 434 4 1 9.3 1 142 0 0	7386 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1E	BERANTIN ROPER IN ROP	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH	SF SF SF ASF ASFABILISF AA	720 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10 18	0.884 0.884 0.834 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 2 434 1 1,142 0 0	7386 0 0 0 0 0 0 1944 1465 1311 333 145 757 0
E	BERANTIN ROPER IN ROP	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 D	SF SF SF ASF ASFABBBS ACA	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10 18	0.834 0.834 0.834 0.836 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 0 0 0 0 0 1 142 0 0 0	7386 0 0 0 0 0 1944 1485 1311 333 143 757 0 0 0
LE	BERANTIN ROPER IN ROP	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 39816 DUCTWORK REVISE DUCTWORK RELIOCATE LOUVER  CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SF SF SF ASF ASFABILISF AA	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 186 6.10 6.10 6.10 6.10 8.20	0.834 0.884 0.884 0.836 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 2 434 1 1 1 1 1 2 0 0	7386 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
ILLE	BERANTIN ROPER IN ROP	FOUNDATIONS FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 DUCT DAMPER, 38X16 D	SF SF SF DSF DSFDUBSF DDDD	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 166 6.10 6.10 18	0.834 0.834 0.834 0.836 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 0 0 0 0 0 1 142 0 0 0	7386 0 0 0 0 0 1944 1485 1311 333 143 757 0 0 0

CONTINGENCY TOTAL

COMMENTS:

REFRIGERANT → 1580# OF R-12 / MECH ROOM @ GROUND LEVEL
 TWO CHILLERS IN ROOM WITH GAS-FIRED BOILER
 VERY EASY TO ISOLATE THE CHILLER

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

NO NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST (AUSTIN)	QTY	COST
51	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF SF	7.20 1.59	0.884	0	
	2	SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	ŏ	
	3	SUPERSTRUCTURE STEEL FRAMING	SF	4.10	0.936	0	
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	
	4	EXTERIOR CLOSURE					
	•	CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	
	5	ROOFING TAR & GRAVELW/ INSULATION	SF	3.36	0.789	0	
	8	INTERIOR					
	·	HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD	SF	1059 4.13	0.918 0.818	2 434	14
	7	MECHANICAL VENTILATION					
	•	EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	13
		INTAKE LOUVER	SF	41 83	0.874	9.3	3
		DUCT DAMPER, 24x18 DUCTWORK	EA LB	6.10	0.874	120	
		REVISE DUCTWORK	LB	6.10	0.874	0	
		RELOCATE LOUVER	SF	16	0.874	0	
	8	CONTROLS DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	
		THERMOSTAT, 120V-1PH	EA	85	0.874	i	
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1
	9	ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0,787	1	1
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	7
				CONTIN	SENCY		
REFF	NGERAN CHILLER	T = 1200# OF R-11 / MECH ROOM @ GROUND LE S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER	VEL	TOTAL			9
. REFF . TWO . VERY	NGERAN CHILLER	S IN ROOM WITH GAS-FIRED BOILER		TOTAL			9
. REFF . TWO . VERY	RIGERAN CHILLER FEASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER	SF SF		0.884 0.884	0 0	9
. REFF	RIGERAN CHILLER FEASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE	SF SF	720 159	0.884 0.884	0	•
. REFF . TWO . VERY	CHILLER CHILLER CHASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF	720	0.884		9
. REFF . TWO . VERY	CHILLER CHILLER CHASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 6*SLAB ON GRADE, GRAV, VAP BAR	SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884	0	9
. REFF	RIGERAN CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING	SF SF SF SF	7.20 1.59 8.03 2.19	0.884 0.884 0.884 0.884	0	9
. REFF	RIGERAN CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOST, STL DECK	SF SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884	0	9
. REFF	RIGERAN CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD SUPERSTRUCTURE STEEL FRAMING	SF SF SF SF	7.20 1.59 8.03 2.19	0.884 0.884 0.884 0.884	0	9
. REFF . TWO . VERY	RIGERAN CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE	\$F \$F \$F \$F	7.20 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884	0 0	94
. REFF	RIGERAN CHILLER FEASY TO 2 3	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION	5F 5F 5F 5F 5F 5F	720 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.938 0.938	0 0 0	9
. REFF . TWO . VERY	ORIGERAN CHILLER YEASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING	5F 5F 5F 5F 5F 5F	720 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.938 0.938	0 0 0	1
. REFF . TWO . VERY	RIGERAN CHILLER FEASY TO 2 3	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION	SFF SF SF SF SF SF	720 1.59 6.03 2.19 4.10 2.93 9.83 3.38	0.884 0.884 0.884 0.938 0.938 0.912 0.789	0 0 0 0 0 2 287	1
. REFF	RIGERANT CHILLER / EASY TO	S IN ROOM WITH GAS-FIRED BOILER D ISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL WI INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAM, ROOF CENTRIFUGAL	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13	0.884 0.884 0.884 0.884 0.936 0.812 0.789 0.918 0.818	0 0 0 0 0 2 287	1
. REFF . TWO . VERY	RIGERANT CHILLER / EASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	SF SF SF SF SF SF SF SF SF SF SF SF SF S	720 1.59 6.03 2.19 4.10 2.93 9.83 3.38 1059 4.13	0.884 0.884 0.884 0.938 0.938 0.912 0.789	0 0 0 0 0 2 287	1
. REFF . TWO . VERY	RIGERANT CHILLER / EASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAYEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT DAMPER, 20x16 DUCT DAMPER, 20x16	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874	0 0 0 0 0 0 2 287	1
REFF TWO	RIGERANT CHILLER / EASY TO	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13	0.884 0.884 0.884 0.838 0.936 0.812 0.739 0.918 0.818	0 0 0 0 0 0 2 287	1
REFF TWO	RIGERANT CHILLER / EASY TO	S IN ROOM WITH GAS-FIRED BOILER D ISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION EXHAUST FAIN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RELOCATE LOUVER CONTROLS	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 2 287 1 5.5 1 100 0	1
2. TWO	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCTWORK REVISE DUCTWORK RELICATE LOUVER CONTROLS DAMPER ACTUATOR, 120V-1PH	SFF SF SF ASF ASFABILISF A	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 2 287 1 5.5 1 100	1
REFF TWO	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILER D ISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION EXHAUST FAIN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RELOCATE LOUVER CONTROLS	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 0 2 287 1 5.5 1 1 100 0	1
REFF TWO	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAYEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20%18 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 0 0 2 287 1 100 0 0	1
REFF TWO	CHILLER  1  2  3  4  5  6	S IN ROOM WITH GAS-FIRED BOILER D ISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL WI INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20:16 DUCTWORK REVSE DUCTWORK RELOCATE LOUVER CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL  WIRE & CONDUIT, 1/3 HP FAN MOTOR	SFF SF SF SF SF SFASF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10 8.5 1200	0.884 0.884 0.884 0.884 0.936 0.812 0.789 0.918 0.814 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 2 287 1 1.5.5 1 100 0 0	1:
. REFF . TWO . VERY	CHILLER  1  2  3  4  5  6	S IN ROOM WITH GAS-FIRED BOILER DISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAYEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20%18 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 0 0 2 287 1 100 0 0	1
. REFF . TWO . VERY	CHILLER  1  2  3  4  5  6	S IN ROOM WITH GAS-FIRED BOILER D ISOLATE THE CHILLER  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCTTOWNK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTSORK CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SFF SFF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.812 0.739 0.918 0.818 0.874 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 2 287 1 5.5 1 100 0 0	1

REFRIGERANT = 415# OF R-113 / MECH ROOM IN BASEMENT
 CHILLER IN ROOM WITH GAS-FIRED BOILER
 FAIRLY SIMPLE TO ISOLATE THE CHILLER, VENTILATION REVISION DIFFICULT
 WATCH OUT FOR TUBE PULL ON CHILLER

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST (AUSTIN)	QTY	TOTAL
14023	1	FOUNDATIONS			6.100.137		
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	ō	ō
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	ò	0
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	0	0
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.938	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ŏ	ò
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
	٠	TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	287	970
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1025	0.874	- 1	898
		INTAKE LOUVER	SF	41	0.874	5.5	197
		DUCT DAMPER, 20x16	EA	77	0.874	1	67
		DUCTWORK	LB	6.10	0.874	100	533
		REVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	16	0.874	0	0
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/3 HP FAN MOTOR	EA	775	0.787	1	610
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	6780
				CONTING	SENCY		1.20
COMMEN	TS:			TOTAL			8138

REFRIGERANT - 415# OF R-113 / MECH ROOM IN BASEMENT
 CHILLER IN ROOM WITH GAS-FIRED BOILER
 FAIRLY SIMPLE TO ISOLATE THE CHILLER, VENTILATION REVISION DIFFICULT
 WATCH OUT FOR TUBE PULL ON CHILLER.

21002	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	\$F	7.20	0.884	352	2240
		EXCAVATION & BACKFILL	SF	1.59	0.884	352	495
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	352	1876
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	72	138
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	352	1351
		ROOF, OPEN WEB JOIST, STLIDECK	SF	2.93	0.936	352	965
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	530	4230
	5	ROOFING					
		TAR & GRAVELW/ INSULATION	SF	3.36	0.789	352	933
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	0	0
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	269
		DUCT DAMPER, 24x16	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	110	586
		REVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	18	0.874	25	350
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	622
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	352	720
							19675
				CONTINGE	NCY		1.20
COMMENTS	:			TOTAL			23610

REFRIGERANT - 680# OF R-12 / MECH ROOM @ GROUND LEVEL
 CHILLER IN ROOM WITH GAS-FIRED BOILERS AND AIR-HANDLING UNIT
 VERY DIFFICULT TO SOLATE THE CHILLER IN SAME LOCATION
 RECOMMEND EXTENDING NORTH END OF THE MECH ROOM 10°, OR WEST END IF TOWER IS REPLACED.

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	ADJUST (AUSTIN)	QTY	TOTAL
27004	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	0	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	0
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	0	0
	3	SUPERSTRUCTURE					_
		STEEL FRAMING	SF	4.10	0.936	0	9
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING				_	
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	194
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	288	973
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	. 1	1311
		INTAKE LOUVER	SF	41	0.874	9.3	333
		DUCT DAMPER, 24x18	EA	93	0.874	1	
		DUCTWORK	LB	8.10	0.874	120	64
		REVISE DUCTWORK	LB	6.10	0.874	0	9
		RELOCATE LOUVER	SF	16	0.874	v	
	8	CONTROLS	***		0.874	1	220
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	i	5
		THERMOSTAT, 120V-1PH	EA	65	0.874	- ;	104
		REFRIGERATION SENSOR/ALARM	EA	1200	U.874	'	104
	9	ELECTRICAL	EA	790	0.787		62
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	147	0.787	2	23
		EMERG SHUT-DOWN & VENT SWITCHES	SF	2.60	0.787	0	23
		LIGHTS & RECEPTACLES	SF	2.60	0.767	v	748
				CONTIN	GENCY		1.20
					02101		8960
COMMENT	rs:			TOTAL	GENCY		-

REFRIGERANT = 1300# OF R-12 / MECH ROOM @ GROUND LEVEL
 CHILLER IN ROOM WITH GAS-FIRED BOILERS
 TIGHT, BUT SHOULD BE ABLE TO SQUEEZE IN WALL TO ISOLATE THE CHILLER

28000	1	FOUNDATIONS	SF	7.20	0.884	0	0
		FOUNDATION & FOOTINGS	SF	1.59	0.884	ŏ	ō
		EXCAVATION & BACKFILL	SF	1.59	0.884	v	•
	2	SUBSTRUCTURE					
		6° SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	0
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	0	0
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING				_	
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6	INTERIOR				2	1944
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	240	811
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	240	•11
	7	MECHANICAL VENTILATION		****	0.874	1	1311
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	7.5	269
		INTAKE LOUVER	SF EA	41 93	0.874	1.5	81
		DUCT DAMPER, 24x16	LB	6.10	0.874	110	586
		DUCTWORK	LB	6.10	0.874	270	1439
		REVISE DUCTWORK	SF	16	0.874	16	224
		RELOCATE LOUVER	<b>SF</b>	10	V.074	10	224
	8	CONTROLS	EA	259	0.874	1	226
		DAMPER ACTUATOR, 120V-1PH	EA	23 W	0.874	i	57
		THERMOSTAT, 120V-1PH	EA	1200	0.874	i	1049
		REFRIGERATION SENSOR/ALARM	EA	1200	0.674	•	1040
	9	ELECTRICAL	EA	790	0.787	1	622
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	ĒĀ	147	0.787	2	231
		EMERG SHUT-DOWN & VENT SWITCHES	SF	2.60	0.787	5	٠.
		LIGHTS & RECEPTACLES	36	2.00	0.707		8850
				CONTING	ENCY		1.20
				TOTAL	L 101		10620
COMMENTS:				IOIAL			.0020

^{1.} REFRIGERANT - 780# OF R-12 / MECH ROOM @ GROUND LEVEL
2. TWO CHILLERS IN ROOM WITH GAS-FIRED BOILER
3. VERY EASY TO ISOLATE THE CHILLER
4. WATCH TUBE-PULL CLEARANCES AND WALLFLUE HEADER CONFLICTS

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	UNIT	COST ADJUST (AUSTIN)	QTY	TOTAL
29005	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	ŏ	ŏ
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	0
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	0	ů.
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ŏ	ŏ
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
	•	TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6	INTERIOR					
	-	HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	284	892
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	9.3	333
		DUCT DAMPER, 36x16	EA	166	0.874	1	145
		DUCTWORK	LB	6.10	0.874	142	757
		RÉVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	16	0.874	0	0
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	85	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1 HP FAN MOTOR	EA	820	0.787	1	645
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	0
							7590
~~	<b></b>			CONTING	ENCY		1.20
COMMEN	3:			TOTAL			9108

REFRIGERANT = 1760# OF R-11 / MECH ROOM @ GROUND LEVEL
 TWO CHILLERS IN ROOM WITH GAS-FIRED BOILER
 VERY EASY TO ISOLATE THE CHILLER, BUT LOTS OF LARGE PIPE PENETRATIONS IN NEW WALL

31008	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	· SF	7.20	0.884	352	2240
		EXCAVATION & BACKFILL	SF	1.59	0.884	352	495
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	352	1876
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	72	138
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.938	352	1351
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	352	965
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	530	4230
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	352	933
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	0	
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	9.3	333
		DUCT DAMPER, 24x18	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	120	640
		REVISE DUCTWORK	LB	6.10	0.874	0	
		RELOCATE LOUVER	SF	16	0.874	25	350
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	228
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	622
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	352	720
							19793
				CONTINGE	NCY		1.20
COMMENTS:				TOTAL			23752

REFRIGERANT - 1350# OF R-22 / MECH ROOM @ GROUND LEVEL
 CHILLER IN ROOM WITH GAS-FIRED BOILERS
 VERY DIFFICULT TO ISOLATE THE CHILLER
 RECOMMEND EXTENDING END OF THE MECH ROOM 8*

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST (AUSTIN)	QTY	TOTAL
34008	1	FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF SF	7.20 1.59	0.884 0.884	352 352	2240 495
	2	SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD	SF	6.03 2.19	0.884 0.884	352 72	1876 139
	3	SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF	4.10 2.93	0.936 0.936	352 352	1351 965
	4	EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	530	4230
	5	ROOFING TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	352	933
	8	INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD	EA SF	1059 4.13	0.918 0.818	2	1944
	7	MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 24x18 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER	EA SF EA UB SF	1500 41 93 6.10 6.10	0.874 0.874 0.874 0.874 0.874 0.874	1 9.3 1 120 0 25	1311 333 81 640 0 350
	•	CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSORALARM	EA EA	259 65 1200	0.874 0.874 0.874	1 1	226 57 1049
	9	ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES LIGHTS & RECEPTACLES	EA EA SF	790 147 2:50	0.787 0.787 0.787 GENCY	1 2 352	522 231 720 19793
2. CHI 3. VEF	FRIGERAN LLER IN R	IT = 1350# OF R-22 / MECH ROOM @ GROUND LEVE OOM WITH GAS-FIRED BOILERS JUT TO ISOLATE THE CHILLER EXTENDING END OF THE MECH ROOM 8"	L	TOTAL			23752
36000	1	FOUNDATIONS FOUNDATION & FOOTINGS	SF	7.20 1.59	0.884 0.884	0	
	2	EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD	SF SF	6.03 2.19	0.884 0.884	84 84	445 163
		CHOCOCTOLYTHIDE					

36000	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	0	0
	2	SUBSTRUCTURE					
	_	6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	84	448
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	84	163
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STLIDECK	SF	2.93	0.936	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	ō
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6	INTERIOR				-	
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	4	3889
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	2865	9679
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	. 1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	269
		DUCT DAMPER, 24x16	EA	23	0.874	1	81
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	9.3	333
		DUCT DAMPER, 36x16	EA	166	0.874	1	145
		DUCTWORK	LB	6.10	0.874	252	1344
		CONTROLS				_	
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	2	453
		THERMOSTAT, 120V-1PH	EA	65	0.874	2	114
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	2	209
	9	ELECTRICAL			0.787		623
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790		1	483
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	4	845
		WIRE & CONDUIT, 1 HP FAN MOTOR	EA	820	0.787	1	04
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	2336
				CONTING	ENCY		1.20
COMMENTS:				TOTAL			28042

REFRIGERANT - 880# & 1840# OF R-11 IN DIFF RMS / MECH RMS ABOVE GRADE
 CHILLERS IN ROOMS WITH GAS-FIRED BOILERS AND EMERGENCY GENERATIORS
 CHILLER ISOLATION SMPLE IN ROOM FOR TWO, BUT DOORS WILL HAVE TO DOUBLE AS TUBE-PULL ACCESS
 CHILLER ISOLATION MORE DIFFICULT FOR LONE UNIT. MUST MOVE CHILLER A FEW FEET.

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

BLDG NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST	QTY	TOTAL
36006	1	FOUNDATIONS			(AUSTIN)		
	•	FOUNDATION & FOOTINGS					
		EXCAVATION & BACKFILL	SF	7.20	0.884	0	
		DIONALICITA BACKFILL	SF	1.59	0.884	0	
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	8.03	0.884	40	
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	48 48	256
			•		0.004	48	\$3
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936		
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	0
			•	2.43	0.936	U	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812		_
			•	v.03	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	
					0.765	U	0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818		1944
			•	7.13	0.616	520	1757
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	_	
		INTAKE LOUVER	SF	41	0.874	_1	1311
		DUCT DAMPER, 24x16	ĒĀ	93	0.874	7.5	269
		DUCTWORK	LB	6.10		. 1	81
		REVISE DUCTWORK	LB	6.10	0.874	110	586
		RELOCATE LOUVER	SF		0.874	120	640
			SF.	16	0.874	18	224
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259			
		THERMOSTAT, 120V-1PH	ĒĀ	65	0.874	1	226
		REFRIGERATION SENSOR/ALARM	ĒĀ	1200	0.874	1	57
			E^	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787		
		EMERG SHUT-DOWN & VENT SWITCHES	ĒĀ	147		1	622
		LIGHTS & RECEPTACLES	SF	2.60	0.787	2	231
		*****	01	2.00	0.787	0 .	0
				CONTINGE	NOV		9348
OMMENTS	:			TOTAL	NOT		1.20
		= 650# OF R-11 / MECH ROOM @ GROUND LEVEL		IOIAL			11215

REFRIGERANT = 850# OF R-11 / MECH ROOM @ GROUND LEVEL
 CHILLER IN ROOM WITH GAS WATER HEATERS AND AIR-HANDLING UNIT
 CHILLER & PUMP RELOCATION REQUIRED TO GAIN SPACE FOR ISOLATION

36014	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20			
		EXCAVATION & BACKFILL	SF	1.59	0.884	0	0
			36	1.59	0.884	0	0
	2	SUBSTRUCTURE					
		6° SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884		
		DEMOUSH HOUSEKEEPING PAD	SF	2.19		0	0
			J.	2.19	0.884	0	0
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936		
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.938	0	0
			35	2.93	0.936	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83			
			SF	9.83	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF				
		The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	56	3.36	0.789	0	0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	-				
		PARTITION, STL STUD / GYP, 1-HR, PTD	EA	1059	0.918	1	972
		THE STATE OF COLOR OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF STATE OF	SF	4.13	0.818	120	405
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL					
		INTAKE LOUVER	EA	1025	0.874	1	898
		DUCT DAMPER, 20x18	SF	41	0.874	5.5	197
		DUCTWORK	EA	77	0.874	1	67
		REVISE DUCTWORK	LB	6.10	0.874	100	533
		RELOCATE LOUVER	LB	6.10	0.874	0	ō
		THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE S	SF	16	0.874	0	0
	a	CONTROLS					
	•	DAMPER ACTUATOR, 120V-1PH					
		THERMOSTAT, 120V-1PH	EA	259	0.874	1	226
		REFRIGERATION SENSOR/ALARM	EA	65	0.874	1	57
		THE THOUSAND SENSON ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
	•	WIRE & CONDUIT, 1/3 HP FAN MOTOR					
		EMERG SHUT-DOWN & VENT SWITCHES	EA	775	0.787	1	610
		LIGHTS & RECEPTACLES	EA	147	0.787	2	231
		TOTAL MEDEL INCLES	SF	2.60	0.787	0	0
						-	5243
OMMENTS:				CONTINGE	NCY		1.20
				TOTAL		-	6292

REFRIGERANT = 175# OF R-22 / MECH ROOM IN BASEMENT
 CHILLER IN ROOM WITH GAS-FIRED WATER HEATER
 RELOCATE CHILLER AND WATCH OUT FOR TUBE PULL
 VENTILATION REVISION DIFFICULT

#### APPENDIX I

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

NT DG			UNIT	COST	COST ADJUST (AUSTIN)	QTY	COST
15	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS EXCAVATION & BACKFILL	SF SF	7.20 1.59	0.884	0	
		EXCAVATION & BACAPILL	<b>.</b>	1.50	2.23	•	
	2	SUBSTRUCTURE			0.884		84
		6° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD	SF SF	6.03 2.19	0.884	120 120	2
			-				_
	3	SUPERSTRUCTURE		440			
		STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF	4.10 2.93	0.938 0.936	0	
	4	EXTERIOR CLOSURE	SF	9.83	0.812	0	
		CONCRETE BLOCK WALL, PTD	5F	9.63	0.012	٠	
	5	ROOFING		-		_	
		TAR & GRAVEL W/ INSULATION	SF	3.38	0.789	0	
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	19
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	264	
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA SF	1500 41	0.874	1 9,3	13 3
		INTAKE LOUVER DUCT DAMPER, 36x16	EA	168	0.874	1	ĭ
		DUCTWORK	LB	6.10	0.874	142	7
		REVISE DUCTWORK	LB	6.10	0.874	0	
		RELOCATE LOUVER	SF	16	0.874	0	
		CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA EA	259 65	0.874 0.874	1	2
		THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM	EA	1200	0.874	i	10
		The first state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of					
	9	ELECTRICAL	EX	820	0,787	1	8
		WIRE & CONDUIT, 1 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	2
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	
				CONTING	- ENCY		84 1.2
TWO	UGERAN CHILLER	F = 2500# OF R-11 / MECH ROOM @ GROUND LEN S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI		TOTAL			101
REFF	UGERAN CHILLER	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI	ı.	TOTAL			101
REFF TWO RELC	RIGERAN CHILLER XCATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS	SF	720	0.884		101
REFF TWO RELC	RIGERAN CHILLER XCATE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI	ı.	TOTAL		0	101
REFF TWO RELC	RIGERAN CHILLER XCATE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE	SF SF	720 1.59	0.884 0.884	0	101
REFF TWO RELC	CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR	SF SF SF	720 1.59	0.884 0.884 0.884	0	101
REFF TWO RELC	CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE	SF SF	720 1.59	0.884 0.884	0	101
REFF TWO RELC	CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE	SF SF SF SF	720 1.59 6.03 2.19	0.884 0.884 0.884	0	101
REFF TWO RELC	IGERANT CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING	SF SF SF SF	720 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	101
REFF TWO RELC	IGERANT CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE	SF SF SF SF	720 1.59 6.03 2.19	0.884 0.884 0.884	0	101
REFF TWO RELC	IGERANT CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936	0	101
REFF TWO RELC	RIGERANT CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF SF SF SF	720 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0	101
REFF TWO RELC	RIGERANT CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936 0.936	0	101
REFF TWO RELC	RIGERAN CHILLER CONTE OF	S IN ROOM WITH GAS-FIRED BOILER IE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936	0	101
REFF TWO RELC	TIGERAN CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION	SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936 0.936	0	101
REFF TWO RELC	RIGERAN CHILLER CONTE OF	S IN ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR	SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.884 0.936 0.936 0.912	0	
REFF TWO RELC	TIGERAN CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W INSULATION  INTERIOR	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83	0.884 0.884 0.884 0.936 0.936 0.938	0	
REFF TWO RELC	TIGERAN CHILLER CATE OF	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION	SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.884 0.936 0.936 0.912	0	13
REFF TWO RELC	INGERANT CHILLER CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF T	S IN ROOM WITH GAS-FIRED BOILER IF OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAYEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  EXHAUST FAN, ROOF CENTRIFUGAL	SF SF SF SF SF SF SF SF SF SF SF SF SF S	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.918	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	12
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REFF TWO RELC	INGERANT CHILLER CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF THE CONTROL OF T	S IN ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6" SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X18  DUCT DAMPER, 38X18	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 188 6.10	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874	0 0 0 0 0 0 0 384 1 9.3 1	12 13 2
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REFF TWO RELC	I 2 3 4 5 6 7 7	S IN ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 39816 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  COMPROLATION  COMPONING  CONTROLS  DAMPER ACTUATOR, 120V-1PH	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 168 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 384 1 142 0 0	12
REFF TWO RELC	I 2 3 4 5 6 7 7	S N ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATIONS EXCAVATION & POOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8* SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38x16 DUCT DAMPER, 38x16 DUCT DOWNER REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 188 6.10 6.10	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 384 1 9.3 1 142 0 0	12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15
REFF TWO RELC	I 2 3 4 5 6 7 7	S IN ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 39816 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  COMPROLATION  COMPONING  CONTROLS  DAMPER ACTUATOR, 120V-1PH	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 41 168 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 0 384 1 142 0 0	12 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15
REFF TWO RELC	I 2 3 4 5 6 7 7	S N ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERRIGERATION SENSORVALARM  SLECTRICAL	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 8.83 3.36 1059 4.13 1500 41 188 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 384 1 1,33 1,12 0 0	12 12 2 3 1 1
REFF TWO RELC	I 2 3 4 5 6 7 7	S N ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 36x16 DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH TRERIGERATION SENSOR/ALARM  SLECTRICAL WIRE & CONDUIT, 1 HP FAN MOTOR	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.38 1059 4.13 1500 411 168 6.10 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 384 1 9.3 1 142 0 0	12 13 13 13 13 14 15 15 15 15 15 15 15 15 15 15 15 15 15
REFF TWO RELC	I 2 3 4 5 6 7 7	S N ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK REVISE DUCTWORK CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERRIGERATION SENSORVALARM  SLECTRICAL	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 8.83 3.36 1059 4.13 1500 41 188 6.10 6.10 16	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 384 1 1,33 1,12 0 0	15 15 15 15 15 15 15 15 15 15 15 15 15 1
REFF TWO RELC	I 2 3 4 5 6 7 7	S N ROOM WITH GAS-FIRED BOILER IFE OR BOTH CHILLERS TO MAKE ROOM FOR WAI  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W INSULATION  NITERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD (GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 38X16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RELOCATE LOUVER  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERROSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  SLECTRICAL WINE & CONDUIT, 1 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES	SFF SF SF SF SF SF SF SF SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1500 4.11 168 6.10 6.10 11 259 85 1200	0.884 0.884 0.884 0.884 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 384 1 9.3 1 1 142 0 0	101

^{1.} REFRIGERANT = 2350# OF R-11 / MECH ROOM @ GROUND LEVEL 2. TWO CHILLERS IN ROOM WITH GAS-FIRED BOILER 3. VERY EASY TO ISOLATE THE CHILLER

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	COST ADJUST (AUSTIM)	QTY	TOTAL
41003	1	FOUNDATIONS			(7.0010.)		
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	0	ō
	2	SUBSTRUCTURE					
		6° SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	0
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	0	0
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STLIDECK	SF	2.93	0.938	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.38	0.789	0	0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	360	1216
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874	1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	269
		DUCT DAMPER, 24x16	EA	93	0.874	1	81
		DUCTWORK	LB	6.10	0.874	110	586
		REVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	16	0.874	0	0
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	822
		EMERG SHUT-DOWN & VENT SWITCHES LIGHTS & RECEPTACLES	EA SF	147	0.787	2	231
		BORTO & RECEPTACLES	24	2.60	0.787	0	7592
				CONTING	ENCY		1.20
COMMENT	S:			TOTAL			9110

REFRIGERANT = 670# OF R-12 / MECH ROOM IN BASEMENT
 CHILLER IN ROOM WITH GAS-FIRED BOILER
 WERY DIFFICULT TO ISOLATE THE CHILLER AND MAINTAIN CLEARANCES
 RECOMMEND EXTENDING EAST END OF THE MECH ROOM 10, OR NORTH END IF TOWER IS REPLACED

42000	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	o	ő
	2	SUBSTRUCTURE					
		6° SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	0	0
		DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	ŏ	ŏ
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.936	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ō	ŏ
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	. 0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	1	972
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	230	777
	7	MECHANICAL VENTILATION					
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.274	1	1311
		INTAKE LOUVER	SF	41	0.874	7.5	269
		DUCT DAMPER, 24x18	EA	93	0.874	1	81
		DUCTWORK	LB	8.10	0.874	110	586
		REVISE DUCTWORK	LB	6.10	0.874	0	o
		RELOCATE LOUVER	SF	16	0.874	ŏ	ŏ
	8	CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	85	0.874	i	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					
		WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	1	622
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787	0	0
							6181
COMMENTS:				CONTINGE	NCY		1.20
WIMEN 12:				TOTAL			7417

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

PLANT BLDG NO	ITEM	DESCRIPTION	UNIT	COST	ADJUST (AUSTIN)	QTY.	COST
50001	1	FOUNDATIONS					
		FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	۰	0
	2	SUBSTRUCTURE					
		6" SLAB ON GRADE, GRAV, VAP BAR	SF	6.03	0.884	24	128
		DEMOUSH HOUSEKEEPING PAD	SF	2.19	0.884	24	46
	3	SUPERSTRUCTURE					
		STEEL FRAMING	SF	4.10	0.938	0	0
		ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	0
	4	EXTERIOR CLOSURE					
		CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING				_	
		TAR & GRAVEL W/ INSULATION	SF	3.36	0.789	0	0
	6	INTERIOR					
		HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	1	972
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	372	1257
	7	MECHANICAL VENTILATION					898
		EXHAUST FAN, ROOF CENTRIFUGAL	EA	1025	0.874	5.5	197
		INTAKE LOUVER	SF	41	0.874		
		DUCT DAMPER, 20x16	EA	77	0.874	1	67
		DUCTWORK	LB	6.10	0.874	400	2133
		REVISE DUCTWORK	LB	6.10	0.874	0	0
		RELOCATE LOUVER	SF	16	0.874	0	0
		CONTROLS					
		DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	EA	65	0.874	1	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL					***
		WIRE & CONDUIT, 1/3 HP FAN MOTOR	EA	775	0.787	1	810
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	231
		LIGHTS & RECEPTACLES	SF	2.60	0.787		7889
				CONTIN	GENCY		1.20
COMMEN	TS:			TOTAL			9443

REFRIGERANT = 200# OF R-22 / MECH ROOM ABOVE GRADE
 CHILLER IN ROOM WITH GAS-FIRED BOILER
 FAIRLY SIMPLET OI SOLALET THE CHILLER
 MOVE CHILLER TO GET CLEARANCES

50004	1	FOUNDATIONS FOUNDATION & FOOTINGS	SF	7.20	0.884	0	0
		EXCAVATION & BACKFILL	SF	1.59	0.884	0	0
	2	SUBSTRUCTURE	SF	6.03	0.884	40	213
		6" SŁAB ON GRADE, GRAV, VAP BAR Demolish Housekeeping Pad	SF	2.19	0.884	40	77
	3	SUPERSTRUCTURE	SF	4.10	0.938	0	0
		STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	ŏ	ő
	4	EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF	9.83	0.812	0	0
	5	ROOFING					
	·	TAR & GRAVEL W/ INSULATION	SF	3.38	0.789	0	0
	6	INTERIOR HOLLOW METAL DOOR, 1-HR	EA	1059	0.918	2	1944
		PARTITION, STL STUD / GYP, 1-HR, PTD	SF	4.13	0.818	896	3027
	7	MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL	EA	1500	0.874		1311
		INTAKE LOUVER	SF	41	0.874	9.3	333
		DUCT DAMPER, 24x18	EA LB	93 6.10	0.874	120	81 640
		DUCTWORK REVISE DUCTWORK	LB	8.10	0.874	0	~~
		RELOCATE LOUVER	SF	16	0.874	0	(
	8	CONTROLS DAMPER ACTUATOR, 120V-1PH	EA	259	0.874	1	226
		THERMOSTAT, 120V-1PH	ĒĀ	65	0.874	i	57
		REFRIGERATION SENSOR/ALARM	EA	1200	0.874	1	1049
	9	ELECTRICAL WIRE & CONDUIT, 1/2 HP FAN MOTOR	EA	790	0.787	t	62
		EMERG SHUT-DOWN & VENT SWITCHES	EA	147	0.787	2	23
		LIGHTS & RECEPTACLES	SF	2.60	9.787	0	981
				CONTING	ENCY		1.20
COMMENTS	i:			TOTAL			11773

REFRIGERANT - 1200# OF R-11 / MECH ROOM ABOVE GRADE
 THREE CHILLERS IN ROOM WITH GAS-FRED BOILERS AND AIR HANDLING UNITS
 EASY TO SOLATE THE CHILLER IS, OTHER TWO VERY DIFFICULT
 RECOMMEND COMBINING ALL UNITS INTO ONE CHILLER WHEN CHILLERS ARE REPLACED

Table I-5. Calculation of Cost to Upgrade Mechanical Rooms

FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS   FOUNDATIONS	NO NO		DESCRIPTION	UNIT	COST	ADJUST (AUSTIN)	QTY	COST
EXCAVATION & BLOGSTILL  2 SUSTRIBUTION  6 "SLAG CAGGADE, GRAY, VAP BAR  6"SLAG CAGGADE, GRAY, VAP BAR  6"SLAG CAGGADE, GRAY, VAP BAR  7 SF 2.19 0.844 0  3 SUPERSTRUCTURE  5 TELE TRAINING  5 ROCK CAGGADE, CAGAN, VAP BAR  8 CAGGADE, CAGAN, VAP BAR  8 CATERIOR CLOSURE  CONGRETE BLOCK WALL, PTD  5 ROCKING  7 NETHICK  8 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  10 NATERIOR  11 NATERIOR  12 NATIONAL VENTILATION  13 NATERIOR  14 NATIONAL VENTILATION  15 NATIONAL VENTILATION  16 NATIONAL VENTILATION  17 NATIONAL VENTILATION  18 SA 100 0.074 1 1 1311  19 NATIONAL VENTILATION  18 SA 100 0.074 1 1 131  19 NATIONAL VENTILATION  19 SA 10 0.074 0 0.074 1 1 131  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTILATION  10 NATIONAL VENTI	7018	1						
2 SUBSTRUCTURE 6*SLAB ON GRACE GRAY, VAP BAR DEMOISH NOSEKEEPNO PAD  3 SUPERSTRUCTURE STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK SF 2.89 0.595 0  4 EXTERIOR GLOSURE CONCRETE BLOCK WALL, PTD SF 9.83 0.812 0  5 ROCRING TAR A GRAVEL WINSULATION SF 3.36 0.788 0  6 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STLD (1974) -1-HR, PTD SF 4.13 0.818 264 88  8 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION STL STUD (1974) -1-HR, PTD SF 4.13 0.818 264 88  8 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION STL STUD (1974) -1-HR, PTD SF 4.13 0.818 264 88  8 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION STL STUD (1974) -1-HR, PTD SF 4.13 0.817 26  8 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION STL STUD (1974) -1-HR, PTD SF 4.10 0.874 1 1  8 1500 0.874 1 1  8 160 0.874 1 1  8 161 0.874 1 1  8 161 0.874 1 1  8 162 0.874 1 1  8 163 0.874 1 1  8 164 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1  8 165 0.874 1 1								
### STAILS ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPNO PAD  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STEEL FRAMING ROCE, OPEN WEB JOST, STL DECK  ### STAILS ON GRADE CONCRETE BLOCK WALL, PTD  ### STAILS ON GRADE CONCRETE BLOCK WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCH, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAILS ON GRADE ROCE, WALL, PTD  ### STAI			EXCAVATION & BACKFILL	51-	1.59	0.884	0	
DEMOUSH HOUSEKEEPING PAD  3 SUPERSTRUCTURE 3 FIELE FRAMING ROG, O'PH WEB JOIST, STL DECK SF 233 0,336 0  4 EXTERIOR GLOSK WEB JOIST, STL DECK SF 233 0,336 0  4 EXTERIOR GLOSK WEB JOIST, STL DECK SF 233 0,336 0  5 ROGRING TAR & GRAVEL WI NSULATION SF 3,36 0,759 0  6 NITERIOR HOULOW METAL DOOR, 1-HR PARTITION, STL STUD / 0'YP, 1-HR, PTD SF 4,13 0,318 264 86  7 MECHANICAL VENTLATION EXHALST FAN, ROOF CENTRIFUGAL INTAKE LOUVER BY JOINT ON THE ST 1500 0,774 1 131 INTAKE LOUVER BY JOINT ON THE ST 160 0,774 1 141 DUCTWORK LB 6,10 0,774 1 142 DUCT DAMPER, 38x19 EA 166 0,774 1 142 DUCT DAMPER, 38x19 EA 166 0,774 1 142 DUCT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT,		2						
3 SUPERSTRUCTURE STELL FRAMING ROCF, OPEN WEB JOIST, STL DECK SF 233 0,338 0  4 EXTERIOR CLOSINE CONCRETE BLOCK WALL, PTD SF 9,83 0,812 0  5 ROOFING TAR & GRAVEL W, NSULATION SF 3,36 0,789 0  6 NITERIOR MOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / 0 YP, 1-HR, PTD SF 413 0,818 284 88  7 MECHANICAL VENTILATION EXHAUST EARL, NOOF CENTRIFIUGAL INTAKE LOUVER DUCT DAMPER, 39419 EA 1500 0,874 1 131 HATAKE LOUVER SF 41 0,874 9,3 33 DUCT DAMPER, 39419 EA 1600 0,874 1 142 TO STELL FRAMING RECOLATE LOUVER SF 41 0,874 9,3 33 DUCT DAMPER, 39419 EA 1600 0,874 1 142 TO STELL FRAMING RECOLATE LOUVER SF 18 0,874 0 0,874 TO STELL FRAMING RECOLATE LOUVER SF 18 0,874 0 0,874 TO STELL FRAMING SF 18 0,874 1 22 TO STELL FRAMING SF 18 0,874 1 22 TO STELL FRAMING SF 18 0,974 1 22 TO STELL FRAMING SF 18 0,974 1 22 TO STELL FRAMING SF 18 0,974 1 22 TO STELL FRAMING SF 19 0,974 1 1 104 TO STELL FRAMING SF 19 0,974 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0,747 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0,747 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0,747 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0,747 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0 0,747 1 1 104 TO STELL FRAMING SF 1,99 0,984 0 0 0,747 1 1 104 TO STELL FRAMING SF 2,99 0,984 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987 0 0 0,987								
STELL FRAMING ROCF, OPEN WEB JOST, STL DECK SF 2,83 0,305 0  ### EXTERIOR CLOSURE CONGRETE BLOCK WALL, PTD SF 9,83 0,312 0  ### EXTERIOR CLOSURE CONGRETE BLOCK WALL, PTD SF 9,83 0,312 0  ### CONGRETE BLOCK WALL, PTD SF 9,83 0,312 0  #### ROSE OF THE CONGRETE BLOCK WALL, PTD SF 0,306 0,718 0  ### ROSE OF THE CONGRETE BLOCK WALL, PTD SF 0,306 0,718 0  ### PARTITION, STL STUD / GYP, 1-HR, PTD SF 4,13 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0,318 0			DEMOLISH HOUSEKEEPING PAD	SF	2.19	0.884	0	
ROOF, OPEN WEB JOST, STL DECK  4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  5 ROORING TARA GRAVEL W NSULATION  5 ROORING TARA GRAVEL W NSULATION  5 ROORING TARA GRAVEL W NSULATION  6 NITERIOR HOLLOW METAL DOOR, 1-HR HOLLOW METAL DOOR, 1-HR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / 0 YP, 1-HR, PTD  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIPUOAL INTAKE LOUVER  10 DICTYWORK 10 B 6-10 0.674 1 131 INTAKE LOUVER  10 DICTYWORK 11 B 6-10 0.674 1 142 77 RECHANGER AND TO THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE PARTITION OF THE		3	SUPERSTRUCTURE					
### EXTERIOR CLOSURE CONCRETE BLOCK WALL PTD    ROOFING				SF	4.10	0.938	0	
CONCRETE BLOCK WALL, PTD  5 ROOFING TAR A GRAVEL WI NSULATION 5 ROOFING TAR A GRAVEL WI NSULATION 6 NITERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD JOYP, 1-HR, PTD 5 4.13 0.816 284 89 7 MECHANICAL YENTICATION EXHAUST FAN, ROOF CENTRIFUGAL BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LO			ROOF, OPEN WEB JOIST, STL DECK	SF	2.93	0.936	0	
CONCRETE BLOCK WALL, PTD  5 ROOFING TAR A GRAVEL WI NSULATION 5 ROOFING TAR A GRAVEL WI NSULATION 6 NITERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD JOYP, 1-HR, PTD 5 4.13 0.816 284 89 7 MECHANICAL YENTICATION EXHAUST FAN, ROOF CENTRIFUGAL BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LOVER BY HAVE LO		- 2	EXTERIOR CLOSURE					
### NTERIOR  **NITERIOR** **PARTITION, ST. STUD JOYP, 1-HR, PTD  **SP 4.13 0.818 0  **PARTITION, ST. STUD JOYP, 1-HR, PTD  **SP 4.13 0.818 284 89  **TO MECHANICAL VENTILATION  **EXHAUST FAN, ROOF CENTRIFUGAL  **RECHANICAL VENTILATION  **EXHAUST FAN, ROOF CENTRIFUGAL  **RECHANICAL VENTILATION  **EXHAUST FAN, ROOF CENTRIFUGAL  **RECHANICAL VENTILATION  **EXHAUST FAN, ROOF CENTRIFUGAL  **RELOCATE LOUVER  **DUCTWORK  **RELOCATE LOUVER  **SP 4.1 0.874 9.3 33  **DUCTWORK  **RELOCATE LOUVER  **SP 1.6 0.874 0  **TO MAPER ACTUATOR, 120V-1PH  **THERMOSTAT, 100V-19TH  **THERMOSTAT, 100V-19TH  **REPRIFICERATION SENSORVALARM  **PARTITION SENSORVAL				SF	9.83	0.812	0	
TAR 4 GRAVEL WI NSULATION SF 3.96 0.789 0  NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.1059 0.918 0 PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 284 89  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 284 89  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 284 89  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 284 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 284 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.918 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.917 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.917 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.917 193  PARTITION, STL STUD (GYP, 1-HR, PTD) SF 4.13 0.917		_	DAARUA					
NTERIOR		5		ee.	2.24	0.700		
HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GVP, 1-HR, PTD  PARTITION, STL STUD / GVP, 1-HR, PTD  SF 4.13 0.818 2844 889  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER  EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER  BUT DUAMPER, 38x16 EA 1500 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER, 38x16 EA 160 0.874 1 1 141 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH EA 259 0.874 1 1 50 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER, 38x16 EA 147 0.787 2 22 BUT DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER, 120V-1PH THERMOSTAT, 120V-1PH EA 45 0.374 1 1 50 BUT DAMPER, 20X16 EA 100 0.787 1 1 60 BUT DAMPER, 20X16 EA 100 0.787 1 1 60 BUT DAMPER, 20X16 EA 100 0.787 1 1 60 BUT DAMPER, 20X16 EA 100 0.787 1 1 60 BUT DAMPER, 20X16 EA 100 0.787 1 1 60 BUT DAMPER, 20X16 EA 100 0.838 0 0 1 60 BUT DAMPER, 20X16 EA 100 0.838 0 0 1 60 BUT DAMPER, 20X16 EA 100 0.874 1 1 0 0.838 0 0 1 60 BUT DAMPER, 20X16 EA 100 0.874 1 1 0 0.836 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				<b>J</b>	320	0.789	·	
PARTITION, STL STUD (3VP, 1-HR, PTD		6						
7 MECHANICAL VENTILATION ECHALIST FAN, ROOF CENTRIFUGAL INTAKE LOUVER ECHALIST FAN, ROOF CENTRIFUGAL INTAKE LOUVER ECHALIST FAN, ROOF CENTRIFUGAL INTAKE LOUVER B			HOLLOW METAL DOOR, 1-HR					
EXHAUST FAN, ROOF CENTRIFUOAL INTAKE LOUVER INTAKE LOUVER BY DUCT DAMPER, 38x16 EA 186 0.874 1, 1131 DUCTWORK LB 6.10 0.874 1, 27 1, 12 1, 12 1, 12 1, 12 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1, 13 1,			PARTITION, STESTOD / GTP, I-HR, PTD	SF	4.13	0.818	264	89
INTAKE LOUVER   SF   41		7	MECHANICAL VENTILATION					
DUCT DAMPER, 38416 DUCTWORK							1	131
DUCTWORK   LB								
REVSE DUCTYORK RELOCATE LOUVER  8 CONTROLS  DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  9 ELECTRICAL WIRE & CONDUIT, 1 HP FAN MOTOR EMERO SHUT-DOWN & VENT SWITCHES  EA 1200 0.874 1 100  9 ELECTRICAL WIRE & CONDUIT, 1 HP FAN MOTOR EMERO SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 22  EMMENTS:  CONTROLS  CONTROLS  CONTROLS  CONTROLS  CONTROLS  CONTROLS  FOUNDATION & FOOTINGS FOUNDATION & BACKFILL  PURCHAST & BACKFILL  SF 1.59 0.884 0 0 0.787  EVERY EASY TO ISOLATE THE CHILLER  FUNDATION & FOOTINGS ENCAYATION & BACKFILL  SF 1.59 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0 0 0.884 0								
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DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSORIALARM  9 ELECTRICAL WIRE & CONDUT, 1 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 22 LIGHTS & RECEPTACLES  CONTINGENCY TOTAL  MIMENTS:  REFRIGERANT = 1760# OF R-11 / MECH ROOM ABOVE GRADE TWO CHILLERS IN ROOM WITH GAS-FIRED BOILERS  VERY EASY TO ISOLATE THE CHILLER  DOI 1 FOLNDATION & FOOTINGS EYCAVATION & BACKFILL SE 1.59 0.884 0  2 SUBSTRUCTURE 8'SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD STELL FRAMING ROOF, OPEN WEB JOIST, STL DECK  4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD S ROOFING TAR & GRAVEL W/ NSULATION SF 2.13 0.818 120  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFICIAL INTAKE LOUVER SF 4.10 0.974 1 1 87 AND THE CONCRETE BLOCK WALL, PTD SF 4.13 0.818 120  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFICIAL INTAKE LOUVER SF 4.10 0.974 1 1 87 AND THE CONCRETE BLOCK WALL, PTD SF 4.13 0.818 120  8 NTERICR HOLLOW METAL DOOR, 1-HR PARTITION, ST. ST. UT. OF THE PARTITION, SF 4.13 0.818 120  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFICIAL INTAKE LOUVER DUCT DAMPER 20x16 EA 77 0.874 1 87 DUCT DAMPER 20x16 EA 77 0.874 1 87 DUCT DAMPER 20x16 EA 77 0.874 1 87 DUCT DAMPER 20x16 EA 77 0.874 1 87 DUCT DAMPER 20x16 EA 77 0.874 1 87 DUCT DAMPER 20x16 EA 77 0.874 1 1 67 EMERG SHUT-DOWN & VENT SWITCHES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES SF 2.80 0.787 0 2 221 BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPTACLES BIGHTS A RECEPT			RELOCATE LOUVER				ŏ	
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### MMENTS:  REFRIGERANT = 1786# OF R-11 / MECH ROOM ABOVE GRADE TWO CHILLERS IN ROOM WITH GAS-FIRED BOILERS  VERY EASY TO ISOLATE THE CHILLER								
REFRIGERANT = 1780# OF R-11 / MECH ROOM ABOVE GRADE								
FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  2 SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  3 SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  5 ROOFING TAR & GRAVEL W/ INSULATION  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 BEA DICTWORK BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.0574 BE 0.05774 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE 0.05777 BE	. REFF	RIGERANT	S IN ROOM WITH GAS-FIRED BOILERS			BNCY		<u>1.20</u> 6775
EXCAVATION & BACKFILL  2 SUBSTRUCTURE 6* SLAB CN GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  3 SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  5 ROOFING TAR & GRAVEL W/ INSULATION  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 EA 77 0.974 1 894 INTAKE LOUVER DUCT DAMPER, 20x16 EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 894 INTAKE LOUVER EA 77 0.974 1 995 INTAKE LOUVER EA 85 0.874 1 224 INTAKE LOUVER EA 85 0.874 1 224 INTAKE LOUVER EA 85 0.874 1 1048  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 233 INTAKE LOUVER EM 15 15 15 15 15 15 15 15 15 15 15 15 15	I. REFF 2. TWO 3. VERY	RIGERANT CHILLER EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER			ENCY		
2 SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  3 SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK SF 2.93 0.936 0  4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  5 ROOFING TAR & GRAVEL W/ INSULATION SF 3.36 0.769 0  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 405  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT DAMPER, 20x16 EA 77 0.874 1 66 DUCTWORK LB 6.10 0.874 1 66 REVISE DUCTWORK LB 6.10 0.874 0 66 CONTROLS DAMPER ACTUATOR, 120V-1PH HERMOSTAT, 120V-1PH EA 65 0.874 1 225 REPSE DUCTWORK LB 0.874 0 66 CONTROLS DAMPER ACTUATOR, 120V-1PH HERMOSTAT, 120V-1PH EA 65 0.874 1 226 REPSE GOOD OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR STEEL OR S	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER FOUNDATIONS	er.	TOTAL			677
e'S LAB ON GRADE, GRAY, VAP BAR SF 8.03 0.884 0 DEMOUSH HOUSEKEEPING PAD SF 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.884 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.936 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.19 0.812 0 SE 2.	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS		7.20	0.884		677
DEMOUSH HOUSEKEEPING PAD	. REFF . TWO . VERY	RIGERANT CHILLER (EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL		7.20	0.884		677
3 SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK SF 2,93 0,938 0 ROOF, OPEN WEB JOIST, STL DECK SF 2,93 0,938 0 ROOF, OPEN WEB JOIST, STL DECK SF 2,93 0,938 0 ROOF, OPEN WEB JOIST, STL DECK SF 2,93 0,938 0 ROOF, OPEN WEB JOIST, STL DECK SF 2,93 0,938 0 ROOF, OPEN WEB JOIST, STL DECK SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0,812 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0 ROOF, OPEN SF 9,83 0	. REFF . TWO . VERY	RIGERANT CHILLER (EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE	SF	7.20 1.59	0.884 0.884	0	677
STEEL FRAMING   SF   4.10   0.938   0   0   0   0   0   0   0   0   0	. REFF . TWO . VERY	RIGERANT CHILLER (EASY TO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR	SF SF	7.20 1.59	0.884 0.884 0.884	0	677
ROOF, OPEN WEB JOIST, STL DECK  4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  5 ROOFING TAR & GRAVEL W/ INSULATION  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  7 MECHANICAL VENTILLATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK BARD BLOCK	. REFF . TWO . VERY	RIGERANT CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD	SF SF	7.20 1.59	0.884 0.884 0.884	0	6777
4 EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD SF 9.83 0.812 0 0  5 ROOFING TAR & GRAVEL W/ INSULATION SF 3.36 0.789 0 0  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 466  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL FA 1025 0.874 1 894 INTAKE LOUVER SF 41 0.974 5.5 197 DUCT DAMPER, 20x16 EA 77 0.974 1 61 DUCTWORK EB 6.10 0.874 100 533 REVISE DUCTWORK EB 6.10 0.874 0 0 REVISE DUCTWORK EB 6.10 0.874 0 0  8 CONTROLS DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 224 THERMOSTAT, 120V-1PH EA 85 0.874 1 55 REFRIGERATION SENSORYALARM EA 1200 0.874 1 1046  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0 0.787	. REFF . TWO . VERY	RIGERANT CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6° SLAB ON GRADE, GRAV, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE	SF SF SF	7.20 1.59 5.03 2.19	0.884 0.884 0.884	0	6777
CONCRETE BLOCK WALL, PTD SF 9.83 0.812 0  5 ROOFING TAR & GRAVEL W/ INSULATION SF 3.36 0.789 0  6 INTERIOR HOLLOW METAL DOOR, 1-HR PTD SF 4.13 0.818 120 460  7 MECHANICAL VENTILATION EAA 1025 0.874 1 891 INTAKE LOUVER SF 4.1 0.874 5.5 191 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 61 DUCT D'AMPER, 20x16 EA 77 0.874 1 1 61 DUCT D'AMPER, 20x16 EA 8 6.10 0.874 0 61 EA 77 0.874 1 1 224 EA 8 5 0.874 1 224 EA 8 5 0.874 1 224 EA 8 5 0.874 1 1 244 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 5 0.874 1 1 1046 EA 8 6 104 EA 8 6 104 EA 8 6 104 EA 8 6 104 EA 8 6 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 104 EA 8 EA 8 10	. REFF . TWO . VERY	RIGERANT CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTUPE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0 0	6777
5 ROOFING TAR & GRAVEL W/ INSULATION SF 3.36 0.789 0  6 INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 465  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 EA 77 0.874 1 89 INTAKE LOUVER SF 41 0.874 5.5 19 DUCT DAMPER, 20x16 EA 77 0.874 1 6: DUCT WORK LB 6.10 0.874 100 53: REVISE DUCTWORK LB 6.10 0.874 0 6: REVISE DUCTWORK LB 6.10 0.874 0 6: RELOCATE LOUVER SF 18 0.874 0 6:  8 CONTROLS DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 224 THERMOSTAT, 120V-1PH EA 65 0.874 1 5: REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1046  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT, DOWN A VENT SWITCHES EA 147 0.787 2 23: LIGHTS & RECEPTACLES SF 2.60 0.787 0 6.	. REFF . TWO . VERY	RIGERANT CHILLER ( EASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTUPE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0 0	6777
TAR & GRAVEL W/ NSULATION SF 3.36 0.789 0 0  8 NTERIOR HOLLOW METAL DOOR, 1-HR EA 1059 0.918 1 977 PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 4055  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL EA 1025 0.874 1 894 INTAKE LOUVER SF 41 0.874 5.5 197 DUCT DAMPER, 20x16 EA 77 0.874 1 65 DUCTWORK LB 6.10 0.874 100 533 REVISE DUCTWORK LB 6.10 0.874 0 00 RELOCATE LOUVER SF 18 0.874 0 00 RELOCATE LOUVER SF 18 0.874 1 225 DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 225 THERMOSTAT, 120V-1PH EA 65 0.874 1 57 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1046  8 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0000000000000000000000000000	. REFF . TWO . VERY	RIGERANT CHILLER YEASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STELL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE	SF SF SF	7.20 1.59 6.03 2.19	0.884 0.884 0.884 0.884	0 0	6777
TAR & GRAVEL W/ NSULATION SF 3.36 0.789 0 0  8 NTERIOR HOLLOW METAL DOOR, 1-HR EA 1059 0.918 1 977 PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 4055  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL EA 1025 0.874 1 894 INTAKE LOUVER SF 41 0.874 5.5 197 DUCT DAMPER, 20x16 EA 77 0.874 1 65 DUCTWORK LB 6.10 0.874 100 533 REVISE DUCTWORK LB 6.10 0.874 0 00 RELOCATE LOUVER SF 18 0.874 0 00 RELOCATE LOUVER SF 18 0.874 1 225 DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 225 THERMOSTAT, 120V-1PH EA 65 0.874 1 57 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1046  8 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0000000000000000000000000000	. REFF . TWO . VERY	RIGERANT CHILLER YEASY TO 1	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STELL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE	SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936	0	677
6 NTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  7 MECHANICAL VENTILLATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT DAMPER, 20x16 EA 77 0.874 1 66 DUCTWORK LB 6.10 REVISE DUCTWORK LB 6.10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 10 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11 0.874 11	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD	SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936	0	677
HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER SF 41 0.874 1 890 INTAKE LOUVER DUCT DAMPER, 20x16 EA 77 0.874 1 61 DUCTWORK IB 6.10 0.874 100 533 REVISE DUCTWORK IB 6.10 0.874 0 633 REVISE DUCTWORK IB 6.10 0.874 0 633 REVISE DUCTWORK IB 6.10 0.874 0 633 REVISE DUCTWORK IB 6.10 0.874 1 203 REVISE DUCTWORK IB 6.10 0.874 1 203 REVISE DUCTWORK IB 6.10 0.874 1 55 REFORM ACTUATOR, 120V-1PH EA 85 0.874 1 224 THEPMOSTAT, 120V-1PH EA 85 0.874 1 55 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1046  ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES LIGHTS & RECEPTACLES SF 2.80 0.787 1 610	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATION'S FOUNDATION'S FOOTINGS EXCAVATION'S BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAY, VAP BAR DEMOUSEH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING	SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936 0.936	0 0	677
PARTITION, STL STUD / GYP, 1-HR, PTD SF 4.13 0.818 120 400  7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL EA 1025 0.874 1 891 INTAKE LOUVER SF 41 0.874 5.5 187 DUCT DAMPER, 20x16 EA 77 0.874 1 61 DUCTWORK LB 6.10 0.874 100 533 REVISE DUCTWORK LB 6.10 0.874 0 633 REVISE DUCTWORK LB 6.10 0.874 0 633 REVISE DUCTWORK LB 6.10 0.874 0 633 RELOCATE LOUVER SF 18 0.874 1 224 THERMOSTAT, 120V-1PH EA 259 0.874 1 224 THERMOSTAT, 120V-1PH EA 65 0.874 1 55 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1046  8 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0 0.787	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATION'S FOUNDATION'S FOOTINGS EXCAVATION'S BACKFILL  SUBSTRUCTURE 8" SLAB ON GRADE, GRAY, VAP BAR DEMOUSEH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING	SF SF SF SF SF	7.20 1.59 8.03 2.19 4.10 2.93	0.884 0.884 0.884 0.884 0.936 0.936	0 0	677
7 MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL EA 1025 0,874 1 896 INTAKE LOUVER SF 41 0.874 5.5 197 DUCT DAMPER, 20x16 EA 77 0,874 1 66 DUCT DAMPER, 20x16 EA 77 0,874 1 66 DUCTWORK LB 6.10 0,874 100 533 REVISE DUCTWORK LB 6.10 0,874 0 0 RELOCATE LOUVER SF 18 0,874 0 0  8 CONTROLS DAMPER ACTUATOR, 120V-1PH EA 259 0,874 1 226 THERMOSTAT, 120V-1PH EA 65 0,874 1 57 REFRIGERATION SENSOR/ALARM EA 1200 0,874 1 1046  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES EA 147 0,787 2 231 LIGHTS & RECEPTACLES SF 2,80 0,787 0 0 0	. REFF . TWO . VERY	RIGERANT CHILLER EASYTO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR	SF SF SF SF SF	7.20 1.59 6.03 2.19 4.10 2.93 9.83	0.884 0.884 0.884 0.936 0.936 0.936	0 0	677
EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER  BUCT DAMPER, 20x16  DUCT DAMPER, 20x16  EA 77 0.874 1 6:  DUCT DAMPER, 20x16  EA 77 0.874 1 6:  REVISE DUCTWORK  LB 6.10 0.874 0 6:  REVISE DUCTWORK  REVISE DUCTWORK  B 6.10 0.874 0 6:  CONTROLS  DAMPER ACTUATOR, 120V-1PH  THERMOSTAT, 120V-1PH  EA 259 0.874 1 224  THERMOSTAT, 120V-1PH  EA 65 0.874 1 5:  REFRIGERATION SENSOR/ALARM  B ELECTRICAL  WIRE & CONDUIT, 1/3 HP FAN MOTOR  EMERG SHUT-DOWN & VENT SWITCHES  EA 147 0.787 2 23:  LIGHTS & RECEPTACLES  SF 2.80 0.787 0 767 2 23:	. REFF . TWO . VERY	RIGERANT CHILLER EASYTO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR	SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.936 0.936 0.812 0.789	0	977
INTAKE LOUVER	. REFF . TWO . VERY	RIGERANT CHILLER EASYTO	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR	SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.936 0.936 0.812 0.789	0	977
DUCT DAMPER, 20x16	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOUSEH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W. INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION	SF	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36	0.884 0.884 0.884 0.936 0.936 0.812 0.789	0	977
DUCTWORK	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL	\$F \$F\$ \$F \$AF\$ \$A	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.26 1059 4.13	0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818	0 0 0 0 0 0 1 120	9777 9707 400
REVISE DUCTWORK RELOCATE LOUVER  8 CONTROLS DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 220 THERMOSTAT, 120V-1PH EA 65 0.874 1 5 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1040  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES LIGHTS & RECEPTACLES SF 2.60 0.787 0	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 8° SLAB ON GRADE, GRAV, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER	\$F \$F\$ \$F\$ \$A\$F\$ \$A\$F\$	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13	0.884 0.884 0.884 0.894 0.936 0.936 0.812 0.789 0.918 0.818	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	977 40
8 CONTROLS  DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 22V THERMOSTAT, 120V-1PH EA 65 0.874 1 55 REFRIGERATION SENSORYALARM EA 1200 0.874 1 1046  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.60 0.787 0 0	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER BUCT DAMPER, 20X16	\$\$ \$\$\$ \$\$\$ \$\$ \$\$\$ \$\$\$\$	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13	0.884 0.884 0.884 0.936 0.936 0.936 0.918 0.812 0.789 0.918 0.818	0 0 0 0 0 0 0	9777 400 899 191 96
DAMPER ACTUATOR, 120V-1PH	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT WORK	** *** ** ** *** ****	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1025 41 77 6.10	0.884 0.884 0.884 0.936 0.936 0.936 0.912 0.789 0.918 0.818	0 0 0 0 0 0 0 1 120 1 5.5 1	977 465 99191 635
DAMPER ACTUATOR, 120V-1PH EA 259 0.874 1 224 THERMOSTAT, 120V-1PH EA 65 0.874 1 57 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1044  9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.60 0.787 0	. REFF . TWO . VERY	RIGERANT CHILLER EASY TO 1 2 3 4 5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT WORK	** *** ** ** *** ****	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1025 41 77 6.10	0.884 0.884 0.884 0.936 0.936 0.936 0.912 0.789 0.918 0.818	0 0 0 0 0 0 0 1 120 1 5.5 1	9777 9773 403 9949 1919 533
THERMOSTAT, 120V-1PH EA 85 0.874 1 55 REFRIGERATION SENSOR/ALARM EA 1200 0.874 1 1048  B ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0.787	. REFF . TWO . VERY	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATION'S FOUNDATION'S FOOTINGS EXCAVATION'S BACKFILL  SUBSTRUCTURE 8* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR'S GRAVEL W' INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x18 DUCT WORK REVISE DUCTWORK RELOCATE LOUVER	** *** ** ** *** ****	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1025 41 77 6.10	0.884 0.884 0.884 0.936 0.936 0.936 0.912 0.789 0.918 0.818	0 0 0 0 0 0 0 1 120 1 5.5 1	9777 9773 403 9949 1919 533
9 ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VIENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0	. REFF . TWO . VERY	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOLISH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W. INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20X16 DUCTWORK REVISE DUCTWORK REVISE DUCTWORK RECOATE LOUVER  CONTROLS	* ** ** * * * * * * * * * * * * * * * *	7.20 1.59 8.03 2.19 4.10 2.93 9.83 9.83 1059 4.13 1025 41 77 6.10 6.10	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 1 120 1 5.5	9777 9774 9794 99191 9191 9191 9191 9191
WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0.787	. REFF . TWO . VERY	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION  MECHANICAL VENTILATION  DUCT DAMPER, 20X16  DUCT DAMPER, 20X16  DUCT DAMPER, 20X16  CONTROLS  DAMPER ACTUATOR, 120V-1PH  THERMOSTAT, 120V-1PH	* ** ** * * * * * * * * * * * * *	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.26 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 1 120 1 15.5 1 100 0	9777 9773 4059 8991 9191 9191 9191 9191 9191 9191 91
WIRE & CONDUIT, 1/3 HP FAN MOTOR EA 775 0.787 1 610 EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.80 0.787 0 0.787	. REFF . TWO . VERY	CHILLER  1  2  3  4  5	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION  MECHANICAL VENTILATION  DUCT DAMPER, 20X16  DUCT DAMPER, 20X16  DUCT DAMPER, 20X16  CONTROLS  DAMPER ACTUATOR, 120V-1PH  THERMOSTAT, 120V-1PH	* ** ** * * * * * * * * * * * * *	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.26 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 1 120 1 5.5 1 100 0	977:75
EMERG SHUT-DOWN & VENT SWITCHES EA 147 0.787 2 231 LIGHTS & RECEPTACLES SF 2.60 0.787 0 0	. REFF . TWO . VERY	CHILLER 1 1 2 3 4 7	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE 6' SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION  MECHANICAL VENTILATION DUCT DAMPER, 20X18 DUCT DAMPER, 20X18 DUCT DAMPER, 20X18  CONTROLS  DAMPER ACTUATOR, 120V-1PH  THEFINGSTAT, 120V-1PH  REFRIGERATION SENSOR/ALARM	* ** ** * * * * * * * * * * * * *	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.26 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.936 0.936 0.936 0.812 0.789 0.918 0.874 0.874 0.874 0.874	0 0 0 0 0 0 1 120 1 5.5 1 100 0	977:75
	. REFF . TWO . VERY	CHILLER 1 1 2 3 4 7	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATION'S FOUNDATION'S FOOTINGS EXCAVATION'S BACKFILL  SUBSTRUCTURE 6* SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE STEEL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR'S GRAVEL W. INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION EXHAUST FAN, ROOF CENTRIFUGAL INTAKE LOUVER DUCT DAMPER, 20x16 DUCT DAMPER, 20x16 DUCT DAMPER CONTROLS  CONTROLS DAMPER ACTUATOR, 120V-1PH THERMOSTAT, 120V-1PH THERMOSTAT, 120V-1PH REFRIGERATION SENSOR/ALARM  ELECTRICAL WIRE & CONDUIT, 1/3 HP FAN MOTOR	** *** ** * * * * * * * * * * * * * * *	7.20 1.59 6.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1025 41 76.10 6.10 18 259 85	0.884 0.884 0.884 0.836 0.936 0.936 0.938 0.812 0.789 0.918 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 1 120 1 5.5 1 10 0 0	677: 677: 677: 677: 402: 899: 613: 633: 633: 635: 637: 637: 637: 638: 638: 638: 638: 638: 638: 638: 638
	1. REFF 2. TWO 3. VERY	CHILLER 1 1 2 3 4 7	S IN ROOM WITH GAS-FIRED BOILERS DISOLATE THE CHILLER  FOUNDATIONS FOUNDATION & FOOTINGS EXCAVATION & BACKFILL  SUBSTRUCTURE  S'SLAB ON GRADE, GRAY, VAP BAR DEMOUSH HOUSEKEEPING PAD  SUPERSTRUCTURE  STELL FRAMING ROOF, OPEN WEB JOIST, STL DECK  EXTERIOR CLOSURE CONCRETE BLOCK WALL, PTD  ROOFING TAR & GRAVEL W/ INSULATION  INTERIOR HOLLOW METAL DOOR, 1-HR PARTITION, STL STUD / GYP, 1-HR, PTD  MECHANICAL VENTILATION  MECHANICAL VENTILATION  DICHAUST FAN, ROOF CENTRIFUGAL  INTAKE LOUVER  DUCT DAMPER, 20x16  DUCT DAMPER, 20x16  DUCTWORK  REVES DUCTWORK  RELOCATE LOUVER  CONTROLS  DAMPER ACTUATOR, 120V-1PH  THERMOSTAT, 120V-1PH  REFRIGERATION SENSOR/ALARM  ELECTRICAL  WIRE & CONDUIT, 1/3 HP FAN MOTOR  EMERG SHUT-DOWN & VENT SWITCHES	** *** ** * * ** *** **** ***	7.20 1.59 8.03 2.19 4.10 2.93 9.83 3.36 1059 4.13 1025 41 77 6.10 6.10 18	0.884 0.884 0.884 0.884 0.936 0.936 0.812 0.789 0.918 0.818 0.874 0.874 0.874 0.874 0.874 0.874	0 0 0 0 0 0 0 1 120 1 5.5 1 100 0 0	9773 6773 6773 6773 972 403 8986 1977 873 873 1049 8100 8100 8100 8100 8100 8100 8100 810

CONTINGENCY TOTAL

COMMENTS:

MECH ROOM IN BASEMENT ORIGINALLY HOUSED CHILLER
 NEW CHILLER MUST BE SEPARATED FROM GAS-FIRED BOILERS
 VENTILATION REVISION DIFFICULT

APPENDIX I

Table I-6. ECO-1 Summary of Chiller Energy and Cost for Existing Conditions

PLANT	TIND	COST	\$/TON*YR	161	172	154	150	175	188	191	188	151	179	181	185	182	162	168	134	136	144	135	214	194	151	164	180	180	221	179	171	205	164
PLANT EXIST	ENERGY	500	\$YR	25162	17640	18648	33021	22892	44533	32405	64998	25744	25074	26374	39694	84461	35532	158500	61418	62449	184399	37118	20418	18619	167132	183773	40851	37678	28503	61777	161763	24989	1745565
PLANT EXIST	CONSUMP		<b>KWH/YR</b>	244094	165926	195214	371264	216891	406474	351948	744803	303324	285585	309229	458564	925004	399563	1517496	645220	688184	2151556	370301	243532	218801	1576413	1902924	436832	361850	366147	705962	1653448	266784	18483333
PLANT EXIST	PEAK	DEMAND	Υ	126.5	89.5	91.5	158.0	115.9	227.9	157.0	308.8	121.0	119.4	124.2	188.0	408.0	170.0	800.0	301.0	301.0	870.0	185.0	95.5	87.6	847.3	905.0	199.0	190.0	129.2	293.8	800.0	121.8	8531.9
PLANT EXIST	MAX	00100	TONS	155.9	102.8	120.9	220.0	131.1	237.3	170.0	345.8	170.0	140.4	146.0	215.0	465.0	220.0	944.7	460.0	460.0	1277.0	275.0	95.5	96.2	1107.4	1120.0	227.5	209.0	129.2	345.8	948.0	121.8	10657.3
PLANT EXIST	CAP		TONS	200.0	128.4	228.0	220.0	149.8	249.6	170.0	420.0	170.0	140.4	146.0	215.0	465.0	220.0	948.0	460.0	460.0	1277.0	275.0	95.5	96.2	1215.0	1120.0	227.5	209.0	129.2	375.0	948.0	121.8	11079.4
OPER SCHED			HR/YR	4380	4380	4380	4380	4380	4380	4380	8760	8760	4380	4380	4380	4380	4380	4380	4380	4380	8760	4380	4380	8760	4380	4380	4380	4380	8760	8760	4380	4380	
PLANT	CALC	LOAD	TONS	138	91	107	238	116	201	176	306	158	154	166	240	486	238	836	458	485	1155	259	110	96	980	1084	232	189	129	306	905	123	10159
PLANT	O N			121	135	194	410	2805	5764	5792	7050	7051	14020	14023	21002	27004	28000	29005	31008	34008	36000	36006	36009	36014	39015	39043	41003	42000	50001	50004	87018	91001	
PLANT				-	2	က	5	9	7	80	6	9	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	

**APPENDIX I** 

Table I-7. ECO-1 Summary of Chiller Energy and Cost for New Conditions

PLANT	LIND	OUTPUT	COST	136	173	175	139	176	139	137	143	143	131	133	142	122	139	118	134	136	125	137	214	181	121	125	142	138	150	144	119	140	132
PLANT	ENERGY	COST	2	18733	15768	18713	30404	20369	27914	23365	43689	22665	18423	19407	30624	56638	30404	100971	61418	62449	159197	37622	20418	17387	119039	139791	32309	25913	19383	44010	112906	17053	1346982
PLANT	CONSUMP		KWHWB	196855	166771	197909	349943	215406	293284	253789	544903	282469	215098	233845	360388	620266	349943	1055933	645220	688184	1917874	375388	243532	204364	1268308	1447552	345409	272207	253197	574802	1148831	180890	14902560
PLANT	PEAK	DEMAND	ΧX	91.8	77.1	91.5	144.2	9.66	136.8	113.2	200.6	104.1	86.9	90.4	144.0	273.6	144.2	495.6	301.0	301.0	741.6	187.5	95.5	81.8	580.6	688.4	157.4	127.0	87.2	198.0	559.2	83.3	6483.1
PLANT	MAX	OUTPUT	TONS	138.0	91.0	107.0	219.0	116.0	201.0	170.0	306.0	158.0	140.1	146.1	216.0	465.0	219.0	853.2	460.0	460.0	1277.1	275.0	95.5	96.2	0.086	1120.0	227.5	188.1	129.2	306.0	948.0	121.8	10229.8
PLANT NEW/	EXIST	CAP	%	69	71	47	108	77	81	100	73	93	110	114	112	100	108	90	SAME	SAME	100	100	SAME	100	81	100	100	06	100	85	100	100	93
PLANT	CAP		TONS	1		107.0	•															275.0									948.0	121.8	0325.6
OPER SCHED			HRWR	4380	4380	4380	4380	4380	4380	4380	8760	8760	4380	4380	4380	4380	4380	4380	4380	4380	8760	4380	4380	8760	4380	4380	4380	4380	8760	8760	4380	4380	
PLANT	CALC	LOAD	TONS	138	91	107	238	116	201	176	306	158	154	166	240	486	238	836	458	485	1155	259	110	96	980	1084	232	189	129	306	905	123	10159
PLANT BLDG	<u>0</u>			121	135	194	410	2805	5764	5792	7050	7051	14020	14023	21002	27004	28000	29005	31008	34008	36000	36006	36009	36014	39015	39043	41003	42000	50001	50004	87018	91001	
PLANT NO				-	2	က	S	9	7	∞ (	<b>σ</b> (	9	13	4	5	16	17	18	6	20	21	55	g ;	24	25	56	27	58	53	e 3	. 33 . 33	32	

**APPENDIX I** 

Table I-8. ECO-1 Summary of Construction Costs

₩ œ	7,07,40	MAYER W/REB	YRS	21.2	49.3		NONE	76.5		35.0	9.8		14.6	11.3	•	40.6		21.2	50.9	20.5	7.4	39.0	•	6.8	•	NONE	NONE	23.5	•	•	NONE	NONE	•	53.9	6 6	•	10.1	• !	17.4	4.1	16.1	12.8	•	•	89	•	18.8	
REPLACE	704074	COST		138942	94433	•		204172	•	89325	165839	•	135262	247939	•	128273	•	144166	149253	188516	220426	204030	•	417258	•	7820	7820	634196	•		168573	5223	•	68578	460257		4/6195		152222	13/655	149281	235237	•	•	432399	•	151322	5702210
REPLACE		COST	•	138942	90521	3912	87598	107467	96705	89325	160932	4907	135262	128868	119071	128273	0	144166	149253	188516	220426	107325	96705	213829	203429	7820	7820	229177	201135	203884	168573	0	5223	68578	235605	224652	241/28	234467	152222	13/655	149281	210995	12121	12121	220233	212166	151322	5702210
UPGRADE BLDG		EXT COST	49	20760	7438	0	10794	10762	0	14446	6888	0	7386	9797	0	9552	0	8136	8136	23610	8960	10620	0	9108	0	0	0	28042	0	0	11215	0	0	6292	10154	0	/261	0	9110	/41/	9443	11773	0	0	6775	0	6292	280167
REPLACE/ 1 DEMOLISH		EXTCOST		6578	3791	353	0	0	0	3159	0	0	0	0	0	0	0	0	0	8109	0	0	0	0	0	0	0	0	0	0	0	0	353	4259	5416	5416	0	0	8109	3934	0	20375	0	0	0	0	٥	69852
REPLACE/ DEMOLISH		EXTCOST		0	8258	1172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7029	0	1172	1172	0	0	0	0	0 (	0	0	26547	2636	5636	0	0	0	50622
> T	CWER	EXT COST 8		3400	13380	442	3876	0	0	2547	0	0	2890	3570	3570	2890	0	18741	19144	22888	7905	0	0	8704	7412	7820	7820	6800	6800	8109	4675	0	0	1635	10727	9928	9520	9520	3868	3553	0	2125	2125	2125	8704	7412	0	234625
REPLACE/ PDEMOLISH D	כחורובא	EXTCOST		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3698	0	0	0	0	0	0 (	0	0	0	0	0	0	0	0	3698
	7000	W/ REB		16.4	30.7	0	NONE	72.4	0	27.0	9.3	0	13.4	10.5	0	36.5	0	17.1	17.0	14.5	6.8	36.9	0	6.3	0	NONE	NONE	21.5	0	0	NONE	NONE	0	5.	 	0	en C)	0	9.4	10.1	15.1	69	0	0	7.8	0	18.0	
REPLACE	71000000	COST		108204	59599	0	72928	193410	0	69173	158951	0	124986	231002	0	115831	0	117289	121973	133909	203561	193410	0	392034	0	0	0	584445	0	0			0	55220	418616	0	449894	0	131135	122751	139838	164895	0	0	409508	0	145030	5063246
REPLACE	_	COST	49	108204	57654	1945	72928	96705	96705	69173	154044	4907	124986	115501	115501	115831	0	117289	121973	133909	203561	96705	96705	196017	196017	0	0	194335	194335	195775	145654	0	0	22520	209308	209308	224947	224947	131135	122751	139838	150175	7360	7360	204754	204754	145030	5063246
REPLACE/ DEMOLISH	_	EXTCOST	₩.	0	1959	0	0	0	0	0	0	1942	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 (	0	11212	0	0	0	0	0	15348	30461
`	rumr(s) r	EXTCOST		0	6812	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 (	0	10308	0	0	0	0	0	10308	27428
ST	E A A	EXT COST F		0	0	0	0	0	0	0	19905	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 (	0	17569	0	0	0	0	0	17314	54788
- T	כחונובא	COST		108204	48883	1945	72928	96705	96705	69173	134139	2965	124986	115501	115501	115831	0	117289	121973	133909	203561	96705	96705	196017	196017	0	0	194335	194335	195775	145654	0	0	55220	209308	209308	224947	224947	131135	122751	100749	150175	7360	7360	204754	204754	102060	4950569
	2			121	135	135	194	410	410	2805	5764	5764	5792	7050	7050	7051	7051	14020	14023	21002	27004	28000	28000	29005	29005	31008	34008	36000	36000	36000	36006	36009	36014	36014	39015	39015	39043	39043	41003	42000	50001	50004	50004	50004	87018	87018	91001	
PLANT PLANT NO BLDG				-	8		၈	S		9	7		80	თ		5		13	4	15	16	17		18		19	20	51			83	S		54	52		56		27	28	53	8			3		8	

Table I-9. ECO-1 Calculation of Simple Payback Periods (by Plant)

CE	E		PAYBK	w/ REB	YRS	21.2	49.3	NONE	76.5	35.0	8	14.6	11.3	40.6	21.2	500	20.5	7.4	39.0	8 8	NONE	HNCN	23.5	NONE	NONE	53.9	8.9	10.1	17.4	11.4	16.1	12.8	8	18.8	
REPLACE	CHILLER		PAYBACK	COST	ક	138942	94433	87598	204172	89325	165839	135262	247939	128273	144166	149253	188516	220426	204030	417258	7820					m	460257	476195	152222	137655	149281	235237	432399	151322	5702210
SE	ER		PAYBK	w/ REB	YRS	16.4	30.7	NONE	72.4	27.0	6.3	13.4	10.5	36.5	17.1	17.0	14.5	8.9	36.9	6.3	NONE	NONF	21.5	NONE	NONE	43.1	8.1	9.5	14.9	10.1	15.1	6.8	7.8	18.0	
REPLACE	CHILLER		PAYBACK	COST	₩.	108204	59599	72928	193410	69173	158951	124986	231002	115831	117289	121973	133909	203561	193410	392034	0	0	584445	145654	0	55220	418616	449894	131135	122751	139838	164895	409508	145030	5063246
PLANT	UTIL	REBATE		•	\$	2790	2085	1015	3990	1060	3600	3420	0699	3345	3330	3390	2260	14760	3990	28044	•	1	42012	4875	•	2160	30510	31140	3690	3522	2424	7020	29880	2121	243063
	 ≻		_	7	%	56	Ξ	0	œ	Ξ	37	28	33	12	27	26	23	33	4	36	0	0	4	7	0	7	29	24	21	31	32	29	30	32	23
PLANT	ENERGY	COST	SAVED	2	#XX	6459	1872	-65	2617	2523	16619	9040	21309	3079	6651	2969	9070	27823	5128	57529	0	0	25202	-504	0	1232	48093	43982	8542	11765	9120	17767	48857	7936	398583
	0			7	0	6	7	7	9	-	28	28	27	7	22	24	21	33	12	30	0	0	Ξ	7	0	<u>^</u>	20	24	21	22	31	19	31	32	19
PLANT	CONSUMP	SAVED		0,701.047.7	אויטאע	47239	-845	-2695	21321	1485	113190	98159	199900	20855	70487	75384	98176	304738	49620	461563	0	0	233682	-5087	0	14437	308105	455372	91423	89643	112950	131160	504617	85894	3580773
		Ω	_	6	0 5	27	4	0	თ	4	40	28	35	4	27	27	23	33	15	38	0	0	15	7	0	7	31	24	7	33	33	33	30	32	24
PLANT	PEAK	DEMAND	SAVED	ZWVD	עון אאן	34./	12.4	0.0	13.8	16.3	91.1	43.8	108.2	16.9	32.5	33.8	44.0	134.4	25.8	304.4	0.0	0.0	128.4	-2.5	0.0	5.8	266.7	216.6	41.6	63.0	45.0	95.8	240.8	38.5	2048.8
PLANT	NEW/	EXIST	CAP	%	, co	69	71	47	108	77	81	100	73	63	110	114	112	100	108	06	SAME	SAME	100	100	SAME	100	81	100	100	90	100	82	100	100	93
PLANT	NEW	CAP		TONG	200	138.0	91.0	107.0	238.0	116.0	201.0	170.0	306.0	158.0	154.0	166.0	240.0	465.0	238.0	853.2	460.0	460.0	1277.1	275.0	95.5	96.2	980.0	1120.0	227.5	188.1	129.2	306.0	948.0	121.8	10325.6
PLANT	EXIST	CA		TONS		200.0	128.4	228.0	220.0	149.8	249.6	170.0	420.0	170.0	140.4	146.0	215.0	465.0	220.0	948.0	460.0	460.0	1277.0	275.0	95.5	96.2	1215.0	1120.0	227.5	209.0	129.2	375.0	948.0	121.8	11079.4
OPER	SCHED			HRVR	73BO	4500	4380	4380	4380	4380	4380	4380	8760	8760	4380	4380	4380	4380	4380	4380	4380	4380	8760	4380	4380	8760	4380	4380	4380	4380	8760	8760	4380	4380	
PLANT	HAP C		LOAD	TONS	138	2 3	ה <u>י</u>	107	238	116	201	176	306	158	154	166	240	486	238	836	458	482	1155	259	110	96	980	1084	232	189	129	306	905	123	10159
1	מרחם מוס	2			121	- 4	33	194	410	2805	5/64	5792	7050	7051	14020	14023	21002	27004	28000	29002	31008	34008	36000	36006	36009	36014	39015	39043	41003	42000	50001	50004	87018	91001	
PLANT	2				-	- c	VI (	ומי		<b>ن</b> ون	` '	∞ (	ກ ເ	2,		14	5	16	17	<u>~</u>	<u>0</u>	50	21	22	23	24	3 8	7.0	17	87.5	53	30	ਲ :	32	

**APPENDIX I** 

Table I-10. ECO-1 Calculation of Simple Payback Periods (by Payback)

SE	H		PAYBK	w/ REB	YRS	6.8	7.4	0	i σ	5 6	0	10.1	11.4	11.3	14.6	20.5	17.4	16.1	21.2	20.9	21.2	18.8	23.5	35.0	49.3	40.6	39.0	53.9	76.5	NONE	NONE	NONE	NONE	NONE	
REPLACE	CHILLER		PAYBACK	COST	↔	417258	220426	432399	460257	235237	165839	476195	137655	247939	135262	188516	152222	149281	138942	149253	144166	151322	634196	89325	94433	128273	204030	68578	204172				168573	5223	1
CE	ER		PAYBK	w/ REB	YRS	6.3	8.9	7.8	8	6	6.0	9.5	10.1	10.5	13.4	14.5	14.9	15.1	16.4	17.0	17.1	18.0	21.5	27.0	30.7	36.5	36.9	43.1	72.4	NONE	NONE	NONE	NONE	NONE	
REPLACE	CHILLER		<b>PAYBACK</b>	COST	\$	392034	203561	409508	418616	164895	158951	449894	122751	231002	124986	133909	131135	139838	108204	121973	117289	145030	584445	69173	59599	115831	193410	55220	193410	72928	0	0	145654	0	5063246
PLANT	UTIL TIL	REBATE			8	28044	14760	29880	30510	7020	3600	31140	3522	0699	3420	2260	3690	2424	2790	3390	3330	2121	42012	1060	2085	3345	3990	2160	3990	1015	•	•	4875	•	243063
PLANT	ENERGY	COST	SAVED		\$WR %	57529 36	27823 33	48857 30	48093 29	17767 29	16619 37	43982 24	11765 31	21309 33	9040 28	9070 23	8542 21	9120 32	6429 26	6967 26	6651 27	7936 32	25202 14	2523 11	1872 11	3079 12	5128 14	1232 7	2617 8	-65 0	0 0	0	-504 -1	0 0	398583 23
PLANT	CONSUMP	SAVED			KWHYR %	461563 30	304738 33	504617 31	308105 20	131160 19	113190 28	455372 24	89643 25	199900 27	98159 28	98176 21	91423 21	112950 31	47239 19	75384 24	70487 25	85894 32	233682 11	1485 1	-845 -1	20855 7	49620 12	14437 7	21321 6	-2695 -1	0	0 0	-5087 -1	0 0	3580773 19 3
PLANT	PEAK	DEMAND	SAVED		%	304.4 38	134.4 33	240.8 30	266.7 31	95.8 33	91.1 40	216.6 24	63.0 33	108.2 35	43.8 28	44.0 23	41.6 21	42.0 33	34.7 27	33.8 27	32.5 27	38.5 32	128.4 15	16.3 14	12.4 14	16.9 14	25.8 15	5.8 7	13.8 9	0.0	0.0	0.0	-2.5 -1	0.0	2048.8 24
PLANT			CAP	_		_	100	100	81	82	8	100	06	73	100	112	100	100	69	114	110	100	9	77	71	93	108	100	108	47	SAME	SAME	100	SAME	93
PLANT	NEW	CAP			IONS	853.2	465.0	948.0	980.0	306.0	201.0	1120.0	188.1	306.0	170.0	240.0	227.5	129.2	138.0	166.0	154.0	121.8	1277.1	116.0	91.0	158.0	238.0	96.2	238.0	107.0	460.0	460.0	275.0	95.5	10325.6
PLANT	EXIS	CAP		1	CONS	948.0	465.0	948.0	1215.0	375.0	249.6	1120.0	209.0	420.0	170.0	215.0	227.5	129.2	200.0	146.0	140.4	121.8	1277.0	149.8	128.4	170.0	220.0	96.2	220.0	228.0	460.0	460.0			11079.4
OPER	SCHED			0.00	HH/YH	4380	4380	4380	4380	8760	4380	4380	4380	8760	4380	4380	4380	8760	4380	4380	4380	4380	8760	4380	4380	8760	4380	8760	4380	4380	4380	4380	4380	4380	
PLANT	¥ (	CALC	LOAD	1	SNO	836	486	905	980	306	201	1084	189	306	176	240	232	129	138	166	154	123	1155	116	16	158	238	96	238	107	458	485	259	-19	10159
PLANT	פרטפ	S			10000	28005	27004	87018	39015	50004	5764	39043	42000	7050	5792	21002	41003	50001	121	14023	14020	91001	36000	2805	135	7051	28000	36014	410	194	31008	34008	36006	36009	
PLANT	2					20 9	16	31	25	30	7	26	58	თ (	ο į	<del>1</del>	27	29	- :	4 6		35	[2]	ഗ ധ	N	0 !	<b>-</b> 7	24	ഹ	က	<del>ე</del>	50	22	23	

Appendix J: ECO-2 (Install Variable Speed Drives for Chillers)

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

PLANT N BUILDIN DESIGN WINTER	G NO: LOAD:	<b>n</b> .	6 410 238 0 EQ-2M	TONS NOSON	COMPRE CONDEN	SSOR:	NO (LE	AD):		CENT WATER R-123	W/ TURBO	COMPR	ISER:	AJ) ON F	3 1):		7 CENT WATER	
					STATUS					NEW		REFRIG					R-123 NEW	
PEAK DE CONSUN			160.5 316414	KWHYR	CONFIG					PARALLE	a.		URATION				PARALLE	a
DEMAND ENERGY	COST:		\$24,492 \$7,594 \$32,086	MR MR MR	LOAD LE	MIT:		RATE LO	AD:	85 95	*	LOAD LI					NA 100	*
	TPUT COS	<b>₹</b>	\$138	/TONTYR	RATED F	OWER:				119.0 81.9 0.688	TONS   KW   KW/TON	RATED	CAPACIT POWER: EFFICIEN				119.0 81.9 0,688	TONS KW KW/TON
															<del></del> -			
	PLANT LOAD	PLANT LOAD SHED	OCCUR ACTUAL	PLANT DEMAND	CHIL	% RAT CAP ACT	% RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ENERGY CONSUMP	LOAD	% RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
<b>*</b>	TONS	TONS	HR/YR	KW	TONS	7%	%	%	KW	HRYR	KWHYR	TONS	%	*	%	KW	HRYR	KWHYR
0 W	0.0	0.0	4380	0.0	0.0			0	0.0	0	0 1	0.0	0			0.0	0	-
3 S	7.1	0.0	37	1.6	7.1	. 6	15	2	1.6	15	24	0.0	0	0	0	0.0	0	
8.5	19.0	0.0	50	1.6	19.0	16	16	2	1.6	50	80	0.0	0	0	0	0.0	ō	
13 S 18 S	30.9 42.8	0.0	65 83	5.7	30.9	26 36	26	. 7	5.7	65	371	0.0	0	0	0	0.0	0	
23 5	54.7	0.0	106	10.6   18.0	42.8 54.7	48	38 48	13 22	10.6 18.0	83 108	1908	0.0 0.0	0	0	0	0.0	0	
28 S	68.6	0.0	143	27.0	66.6	56	58	33	27.0	143	3861	0.0	0	ŏ	0	0.0	0	
33 S	78.5	0.0	184	37.7	78.5	66	68	48	37.7	184	6937	0.0	0	ŏ	0	0.0	Ň	
38 5	90.4	0.0	232	50.0	90.4	78	78	61	50.0	232	11600	0.0	ŏ	ŏ	ŏ	0.0	ŏ	
43 S	102.3	0.0	259	45.1	51.2	43	43	19	15.6	259	4040	51.1	43	43	36	29.5	259	764
48 S	114.2	0.0	292	52.5	57.1	48	48	24	19.7	292	5752	57.1	48	48	40	32.8	292	957
53 S	126.1	0.0	343	59.8	63.1	53	53	29	23.8	343	8163	63.0	53	53	44	36.0	343	1234
58 S	138.0	0.0	381	68.8	69.0	58	58	35	28.7	381	10935	69.0	58	58	49	40.1	381	1527
63 S	149.9	0.0	388	78.6	75.0	63	63	42	34.4	388	13347	74.9	63	63	54	44.2	388	1715
68 S	161.8	0.0	374	88.4	80.9	69	68	49	40.1	374	14997	80.9	68	68	59	48.3	374	1806
73 S	173.7	0.0	357	98.3	88.9	73	73	56	45.9	357	18386	86.8	73	73	64	52.4	357	1870
78 S 83 S	185.6 197.5	0.0	308 247	110.5   122.0	92.8 98.8	78 83	78 83	65 73	53.2 59.8	308 247	16386	92.8	78	78	70	57.3	308	1784
88 S	209.4	0.0	171	135.2	104.7	83 88	88	83	68.0	171	14771   11628	98.7 104.7	83 88	83 88	76 82	62.2 67.2	247 171	1538
93 S	221.3	0.0	109	148.2	110.7	93	93	92	75.3	109	8208	110.6	93	98 93	82 89	72.9	171	1149
985	233.2	1.1	59	160.5	113.1	95	95	96	78.8	59	4637	119.0	100	100	100	81.9	59	483
103 S	245.1	13.0	25	180.5	113.1	95	95	96	78.6	25	1985	119.0	100	100	100	81.9	25	204
108 S	257.0	24.9	7	180.5	113.1	95	95	96	78.6	7	550	119.0	100	100	100	81.9	7	57
113 5	268.9	38.8	2	160.5	113.1	95	95	96	78.6	2	157	119.0	100	100	100	81.9	2	16
118 S	280.8	48.7	0	160.5	113.1	95	95	96	78.6	ō	0	119.0	100	100	100	81.9	ō	
			8602	ì						4200	157583						3322	15883

PLANT N			7 5764		MASTER	CHILLE	NO (LE	AD):		9	
DESIGN	LOAD:		201 E	TONS	COMPRI	SER:				CENT	W/ TURBO
	TION MOD	EL:	EQ-1		REFRIG STATUS					R-123 NEW	
CONSUM			131.3 230672	KWH/YR		URATION				SINGLE	
DEMAN			\$20,038	ΛΑ	LOAD LI	AD SETP! MIT:	or PHO	HATELO	AU:	NA 95	% %
TOTAL (			\$5,538 \$25,573	MR	RATED (	CAPACIT	Y:			201.0 136.8	TONS KW
UNIT OU	TPUT COS	ST:	\$134	/TONTYR		EFFICIEN	CY:			0.881	KW/TON
%	PLANT	PLANT	ANNUAL	PLANT	CHIL	*	%	*	POWER		
PLANT DSGN	LOAD	LOAD	OCCUR ACTUAL	DEMAND	LOAD	RAT	CAP	POW		OCCUR ADJUST	CONSUMP
LOAD		GILD	AGTORE			ACT	ADJ			A00031	CONSOMI
%	TONS	TONS	HRYR	kw	TONS	%	%	%	KW	HRYR	KWHYR
ow		0.0	4380	0.0		0	0	0	0.0	0	0
3 S 8 S		0.0	37 50	2.7	6.0 16.1	3	15 15	2	2.7 2.7	7 27	73
13 5		0.0	65	2.7		13	15	2	2.7	27 58	151
18 S		0.0	83	4.1		18	18	3	4.1	83	340
23 S		0.0	106	6.8		23	23	5	6.8	106	721
28 \$		0.0	143	10.9	58.3	28	28	8	10.9	143	1559
33 \$		0.0	184	15.0		33	33	11	15.0	184	276
38 S		0.0	232	20.5	76.4	38	38	15	20.5	232	4754
43 S		0.0	259	26.0		43	43	19	26.0	259	8734
48 S		0.0	292	32.8		48	48	24	32.8	292	957
53 S 58 S		0.0	343 381	39.7   47.9	106.5 116.6	53 58	53 58	29 35	39.7 47.9	343	1361
63 S		0.0	388	57.5	126.6	63	58 83	42	57.5	381	1825 2231
68 S		0.0	374	67.0	136.7	88	68	49	67.0	374	2505
73 S		0.0	357	78.6	146.7	73	73	56	76.6	357	2734
78 S		0.0	308	88.9	156.8	78	78	65	88.9	308	2738
83 S		0.0	247	99.9	186.8	83	83	73	99.9	247	2487
88 S		0.0	171	113.5		88	88	83	113.5	171	19409
93 S		0.0	109	125.9		93	93	92	125.9	109	1372
98 S		8.0	59	131.3		95	95	98	131.3	59	7747
103 S		16.0	25	131.3		95	95	96	131.3	25	328
108 S		26.1	7	131.3		95	95	98	131.3	7	91
113 S		38.1	ż	131.3		95	95	96	131.3	2	263
	237.2	46.2	ō	131.3	191.0	95	95	96	131.3	ō	- 7
			8602							4160	230672

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

PLANT NO: BUILDING NO DESIGN LOA WINTER LOA SIMULATION	AD: AD:	Ŀ	7050 306 15 EQ-2M	TONS %DSGN	MASTER COMPRE	ESSOR: ISER: ERANT:	NO (LE	AD):		CENT WATER R-123	W/ TURBO   	COMPRI	SER: ERANT:	I NO (LAC	3 1):		13 CENT WATER R-123	
PEAK DEMAI	ND:		196.6	KW .	STATUS	:				NEW		STATUS					NEW	
CONSUMPT			426890	KWHYR		URATION				PARALLE			URATION				PARALLE	
DEMAND CO	ST.		\$30,001	ΛΆ	LOADL	(D SETP)	or PHO-	HATELO	AU:	85 95	%   %	LOAD LI	SETPOR	41:			NA 100	%
ENERGY CO			\$10,245	MR	40/12 11	*****					· ·							
TOTAL COS	T:		\$40,247	MR	RATED	APACITY	<b>/</b> :			153.0 100.3	TONS	RATED (	CAPACITY POWER:	r:			153.0 100,3	TONS KW
JNIT OUTPU	UT COS	T:	\$135	TONYR	RATED	FFICIEN	CY:			0.656	KW/TON j	RATED I	EFFICIEN	CY:			0.658	KW/TON
K PLA PLANT LOAD DSGN LOAD		PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL LOAD	% RAT CAP ACT	% RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP	CHIL	% RAT GAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUME
K TON	NS	TONS	HRYR	KW .	TONS	%	%	%	ĸw	HRYR	KWHYR	TONS	%	%	%	KW	HR/YR	KWHYR
15 W	45.9	0.0	4380	9.0	45.9	30	30		9.0	4380	39420	0.0			0	0.0	0	
3 \$	9.2	0.0	37	2.0	9.2	6	15	2	2.0	15	30	0.0	0	0	0	0.0	0	
	24.5	0.0	50	2.0	24.5	16	16	2	2.0	50	100	0.0	0	0	0	0.0	0	
	39.8	0.0	65	7.0	39.8	26	26	7	7.0	65	455	0.0	0	0	0	0.0		
	55.1	0.0	83	13.0	55.1	36 46	36 46	13 22	13.0 22.1	83 106	1079   2343	0.0	0	0	0	0.0	0	
	70.4	0.0	106 143	22.1 33.1	70.4 85.7	46 58	46 58	33	33.1	143	2343   4733	0.0	V	ň	Ů	0.0	v	
	85.7 101.0	0.0	184	46.1	101.0	68	66	48	48.1	184	8482	0.0	ŏ	ŏ	ň	0.0	ŏ	
	118.3	0.0	232	61.2	116.3	78	78	61	61.2	232	14198	0.0	ŏ	ŏ	ŏ	0.0	ŏ	
	131.8	0.0	259	55.2	85.8	43	43	19	19.1	259	4947	65.8	43	43	38	36,1	259	935
	146.9	0.0	292	64.2	73.5	48	48	24	24.1	292	7037	73.4	48	48	40	40.1	292	1170
	162.2	0.0	343	73.2	81.1	53	53	29	29.1	343	9981 j	81.1	53	53	44	44.1	343	1512
58 S 1	177.5	0.0	381	84.2	88.8	58	58	35	35.1	381	13373	88.7	58	58	49	49.1	381	1870
	192.8	0.0	388	96.3	96.4	63	63	42	42.1	388	16335	96.4	63	63	54	54.2	388	2103
	208.1	0.0	374	108.3	104.1	88	68	49	49.1	374	18363	104.0	69	68	59	59.2	374	2214
	223.4	0.0	357	120.4	111.7	73	73	56	56.2	357	20063	111.7	73	73	64	64.2	357	2291
	238.7	0.0	308	135.4	119.4	78 83	78 83	65 73	65.2 73.2	308 247	20082   18080	119.3 127.0	78 83	78 83	70 76	70.2 78.2	308 247	216: 188:
	254.0 269.3	0.0	247 171	149.4 165.4	127.0	88 88	83	83	83.2	171	14227	134.6	88	88	82	82.2	171	140
	284.6	0.0	109	181.6	142.3	93	93	92	92.3	109	10061	142.3	93	93	89	89.3	109	973
	299.9	1.5	59	196.6	145,4	95	95	96	98.3	59	5682	153.0	100	100	100	100.3	59	59
	315.2	16.8	25	196.6	145,4	95	95	96	96.3	25	2408	153.0	100	100	100	100.3	25	250
	330.5	32.1	7	198.6	145.4	95	95	96	98.3	7	874	153.0	100	100	100	100.3	7	70
113 S 3	345.8	47.4 62.7	2	196.6 196.6	145.4 145.4	96 95	95 95	98 98	98.3 98.3	2	193 (	153.0 153.0	100	100	100	100.3 100.3	2	20
1100 3	JV1.1	04.7	8602	190.0	140,4	*3	***		***	8580	232346	150.0	100	100	100	100.3	3322	19454

PLANT N			15	!	MASTER	CHILLER	NO (LE	ND):		22	
BUILDIN			21002	TONG	001100	2000				CENT	W/ TURSO
DESIGN			240	TONS	COMPRE					WATER	W/ TURBO
WINTER		_		74LISON							
SIMULA	TION MOD	FL:	EQ-1		REFRIG					R-123 NEW	
PEAK DE			162.6	KW i							
CONSUL	APTION:		285667	KWHYR		URATION				SINGLE	
DEMAND	OCT.		\$24,813	ΛΥR	MAX LEA		or PHU-	HATELO	AU:	NA 95	%
ENERGY			\$6,856	/YR	EOAD L	WII 1 .				90	~
TOTAL C			\$31,669	A/R	RATED (	CAPACITY	<b>r</b> :			240.0	TONS
				i	RATED					169.4	KW
UNIT OU	TPUT COS	ST:	\$139	/TONTYR	RATED S	EFFICIEN	CY:			0.708	KW/TON
	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
PLANT	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	PAT		OCCUR	ENERGY
DSGN		SHED	ACTUAL	i		CAP	CAP	POW		<b>ADJUST</b>	CONSUMP
LOAD						ACT	ADJ				
*	TONS	TONS	HRVYR	ĸw	TONS	*	%	*	ĸw	HR/YR	KWHYR
0 W	0.0	0.0	4380	0.0	0.0	0			0.0		
3 S		0.0	37	3.4	7.2	3	15	2	3.4	7	2
8.5		0.0	50	3.4	19.2	i i	15	2	3.4	27	9:
13 5		0.0	85	3.4	31.2	13	15	2	3.4	56	19
18 S		0.0	83	5.1	43.2	18	18	3	5.1	83	42
23 S		0.0	106	8.5	55.2	23	23	5	8.5	106	90
28 S		0.0	143	13.6	67.2	28	28	8	13.6	143	194
33 S		0.0	184	18.6	79.2	33	33	11	18.6	184	342
38 S	91.2	0.0	232	25.4	91.2	38	38	15	25.4	232	589
43 \$		0.0	259	32.2	103.2	43	43	19	32.2	259	834
48 S		0.0	292	40.7	115.2	48	48	24	40.7	292	1188
53 S	127.2	0.0	343	49.1	127.2	53	53	29	49.1	343	1684
58 S	139.2	0.0	381	59.3	139.2	58	58	35	59.3	381	2259
63 S	151.2	0.0	388	71.1	151.2	63	83	42	71.1	388	2758
68 S	163.2	0.0	374	83.0	163.2	68	68	49	83.0	374	3104
73 S		0.0	357	94.9	175.2	73	73	56	94.9	357	3387
78 S		0.0	308	110.1		78	78	65	110.1	308	3391
83 S	199.2	0.0	247	123.7	199.2	83	83	73	123.7	247	3055
88 S		0.0	171	140.6		88	88	83	140.8	171	2404
93 5		0.0	109	155.8		93	93	92	155.8	109	1698
98 S		7.2	59	182.6		95	95	96	162.6	59	959
103 S		19.2	25	182.6		95	95	96	162.6	25	406
108 S	259.2	31.2	7	182.6	228.0	95	95	98	162.6	7	113
113 S	271.2	43.2	2	182.6	228.0	95	95	96	162.6	2	32
118 S	283.2	55.2	0	182.5	228.0	95	95	96	162.6	0	
										********	

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

													_						
	PLANT!			16 27004		MASTE	A CHITTE	R NO (LE	AD):		23	ļ							
	DESIGN	LOAD:		486	TONS	COMPR	ESSOR:				CENT	W/ TURBO							
	WINTER		<b>.</b>	0	%DSGN	CONDE	NSER:				WATER								
	SIMULA	TION MOD	EL:	EQ-1		REFRIG					R-123 NEW	į							
		EMAND:		262.7	KW	i					HEN								
	CONSU	MPTION:		501083	KWH/YR	CONFIG	URATION	l: T <b></b> -	B4774		SINGLE	i							
	DEMAN	D COST:		\$40,088	ΛΆ	MAXLE	AD SETP	I OF PRO	-HATE LO	AU:	NA 95	%   %							
	ENERG	Y COST:		\$12,026	MB	i						~							
	TOTAL	COST;		\$52,114	MB		CAPACIT	Y:			485.0	TONS							
	UNITO	JTPUT COS	ST:	\$118	/TON"YR		POWER: EFFICIEN	ICY:			273.6 0.588	KW/TON							
	<u> </u>											A	_						
	%	PLANT	PLANT	ANNUAL	PLANT	CHE	%	%	%	POWER		ANNUAL							
	PLANT   DSGN	LOAD	LOAD	OCCUR ACTUAL	DEMAND	LOAD	RAT	CAP	RAT POW		OCCUR ADJUST	CONSUMP							
	LOAD					i	ACT	ADJ			A00001	CONSOM							
	1 %	TONE	TONG	HDAD	10111	1				14141		i							
	~ 	TONS	TONS	HRYR	KW	TONS		*	<u> </u>	KW	HAYR	KWH/YR	_						
	0 W		0.0	4380	0.0	0.0	0	0	0	0.0	0	0							
	3 3 3		0.0 0.0	37 50	5.5 5.5	14.6	3	15	2	5.5	7	39							
	13 5		0.0	85	5.5	83.2	14	15 15	2	5.5 5.5	27 61	336							
	18 5		0.0	83	8.2	87.5	19	19	3	8.2	83	661							
	23 5		0.0	108 143	16.4 24.6	111.8	24 29	24 29	6	16.4	108	1738							
	33 5		0.0	184	32.8	160.4	34	34	12	24.6 32.8	143 184	3518   6036							
	38 5		0.0	232	46.5	184.7	40	40	17	46.5	232	10788							
	43 S		0.0	259 292	57.5 71.1	209.0	45 50	45 50	21	57.5	259	14893							
	53 5	257.6	0.0	343	84.8	257.8	50 55	55	26 31	71.1 84.8	292 343	29761							
	58 5	281.9	0.0	381	106.7	281.9	61	61	39	106.7	381	40653							
	63 5		0.0 0.0	388 374	125.9 145.0	306.2 330.5	66 71	66 71	48 53	125.9 145.0	388 374	48849							
	73 5		0.0	357	166.9	354.8	76	76	61	188.9	357	54230   59583							
	78 S		0.0	308	194.3	379.1	82	82	71	194.3	308	59844							
	83 S   88 S		0.0	247 171	221.6 248.2	403.4 427.7	87 92	87 92	81 90	221.6 246.2	247 171	54735   42100							
	93 5		10.2	109	262.7	441.8	95	95	98	262.7	109	28634							
	98 5		34.5	59	262.7	441.8	95	95	96	262.7	59	15499							
	1035		58.8 83.1	25 7	262.7 262.7	441.8 441.8	95 95	95 95	98 96	262.7 262.7	25 7	6568 ( 1839 )							
	113 5		107.4	2	262.7	441.8	95	95	96	262.7	2	525							
	1185	573.5	131.7	0	262.7	441.8	95	95	96	262.7	0	0							
	i			8602							4165	501083							
-						<u> </u>							-						
-																			
	PLANT	iO:		4.0															
				18		MASTER	CHILLER	R NO (LE)	ND):		27	1	MASTER	CHILLE	R NO (LA	3 1):		26	1
	BUILDIN	G NO:		29005	TONE			R NO (LE	AD):						R NO (LA	3 1):		26	1
		G NO: LOAD:			TONS	COMPRI	ESSOR:	R NO (LE	AD):		CENT	W/ TURBO	COMPRE	ESSOR:	r no (la	3 1):		CENT	
	BUILDIN DESIGN WINTER	G NO: LOAD:	£L:	29005 836	Tons %Dsgn	COMPRI CONDEN REFRIG	ESSOR: NSER: ERANT:	R NO (LE	AD):		CENT WATER R-123	W/ TURBO	COMPRE CONDEN REFRIGE	ESSOR: ISER: ERANT:	r no (la	3 1):			1
	BUILDIN DESIGN WINTER SIMULA	G NO: LOAD: LOAD: TION MODI	£L: 	29005 836 0 EQ-2S	%DSGN	COMPRI	ESSOR: NSER: ERANT:	R NO (LE)	AD):		CENT	W/ TURBO	COMPRE	ESSOR: ISER: ERANT:	aj on f	3 1):		CENT	
-	BUILDIN DESIGN WINTER	G NO: LOAD: LOAD: TION MODI	£1.:	29005 836 0		COMPRI CONDEP REFRIGI STATUS	ESSOR: NSER: ERANT: :	:			CENT WATER R-123		COMPRE CONDEN REFRIGE	ESSOR: ISER: ERANT:		3 1):		CENT WATER R-123 NEW	SNOLE
-	BUILDIN DESIGN WINTER SIMULA PEAK DI CONSUR	G NO: LOAD: LOAD: TION MODI 	EL:	29005 836 0 EQ-2S 485.7 941073	KWH/YR	COMPRI CONDEN REFRIGI STATUS CONFIG MAX LEA	ESSOR: NSER: ERANT: : : : : : : : : : : : : : : : : : :	:		AD:	CENT WATER R-123 NEW SERIES/S	NGLE	COMPRE CONDEN REFRIGE STATUS: CONFIGE MIN LAG	ESSOR: ISER: ERANT: : URATION	i:	3 1):		CENT WATER R-123 NEW SERIES/S	%
_	BUILDIN DESIGN WINTER SIMULA	G NO: LOAD: LOAD: TION MODI 	£L:	29005 836 0 EQ-2S 485.7	%DSGN	COMPRI CONDEP REFRIGI STATUS	ESSOR: NSER: ERANT: : : : : : : : : : : : : : : : : : :	:		AD:	CENT WATER R-123 NEW SERIES/S	NGLE	COMPRE CONDEN REFRIGE STATUS:	ESSOR: ISER: ERANT: : URATION	i:	3 1):		CENT WATER R-123 NEW SERIES/S	
_	BUILDIN DESIGN WINTER SIMULA PEAK DI CONSUI	G NO: LOAD: LOAD: TION MODI BMAND: APTION: COST:	£L:	29005 836 0 EQ-2S 485.7 941073 \$74,118	KW KWHYR YR	COMPRIGONDER REFRIGI STATUS CONFIGURANT LEVEL LOAD LI RATED 6	ESSOR: NSER: ERANT: E URATION AD SETPT MIT: CAPACITY	t or PRO-		AD:	CENT WATER R-123 NEW SERIES/S 95 95	NGLE %	COMPRE CONDEN REFRIGE STATUS: CONFIGI MIN LAG LOAD LIII	ESSOR: USER: ERANT: URATION SETPOIL MIT: CAPACIT	l: NT:	3 1):		CENT WATER R-123 NEW SERIES/S	%
	BUILDIN DESIGN WINTER SIMULA* PEAK DI CONSUR DEMAND TOTAL (	G NO: LOAD: LOAD: TION MODI BMAND: APTION: O COST: COST:		29005 836 0 EQ-2S 485.7 941073 \$74,118 \$22,586 \$96,704	KW KWHYR /YR /YR	COMPRI CONDET REFRIGI STATUS CONFIG MAX LE/ LOAD LI	ESSOR: NSER: ERANT: URATION AD SETPT MIT: CAPACITY POWER:	: f or PRO- f:		AD:	CENT WATER R-123 NEW SERIES/S 95 95 426.8 247.8	NGLE % % TONS KW	COMPRECONDED REFRIGE STATUS: CONFIGURATION LOAD LIB RATED C RATED C	ESSOR: ISER: ERANT: : URATION I SETPOI MIT: CAPACIT	l: NT: Y:	3 1):		CENT WATER R-123 NEW SERIES/5 70 100 428.6 247.8	% TONS
	BUILDIN DESIGN WINTER SIMULA PEAK DI CONSUL DEMAND BNERGY TOTAL UNIT OU	G NO: LOAD: LOAD: TION MODI EMAND: MPTION: COST: COST: COST:	iT:	29005 836 0 EQ-2S 485.7 941073 \$74,118 \$22,586 \$96,704 \$116	KW KWHYR AYR AYR AYR ATONIYR	COMPRI CONDET REFRIGI STATUS CONFIG MAX LE/ LOAD LI RATED ( RATED )	ESSOR: NSER: ERANT: E URATION AD SETPT MIT: CAPACITY	: f or PRO- f:		AD:	CENT WATER R-123 NEW SERIES/S 95 95	NGLE %	COMPRE CONDEN REFRIGE STATUS: CONFIGI MIN LAG LOAD LIII	ESSOR: ISER: ERANT: : URATION I SETPOI MIT: CAPACIT	l: NT: Y:	3 1):		CENT WATER R-123 NEW SERIES/5 70 100	% TONS
	BUILDIN DESIGN WINTER SIMULA* PEAK DI CONSUL DEMANCE BNERGY TOTAL C	G NO: LOAD: LOAD: TION MODI EMAND: APTION: COST: COST: COST: TPUT COS	rT:	29005 836 0 EQ-25 485.7 941073 \$74,118 \$22,586 \$96,704 \$116	KW KWHYR  //R  //R  //R  //R  //R  //R  //R	COMPRISON CONDETENTIAL CONFIGURAL LEAD LEAD LEAD LEAD LEAD LEAD LEAD LE	ESSOR: NSER: ERANT: URATION AD SETPT MIT: CAPACIT POWER: EFFICIEN	: f or PRO- f: CY:	RATE LO.	AD:	CENT WATER R-123 NEW SERIES/S 95 95 426.6 247.8 0.581	TONS KW KW/TON I	COMPRE CONDEN REFRIGE STATUS: CONFIGE MIN LAG LOAD LE RATED C RATED F RATED E	ESSOR: ISSER: ERANT: URATION SETPOIL MIT: CAPACIT POWER: EFFICIEN	t: NT: Y: CY:	54	POWER	CENT WATER R-123 NEW SERIES/S 70 100 428.8 247.8 0.581	TONS KW KW/TON
	BUILDIN DESIGN WINTER SIMULA* PEAK DI CONSUL DEMANG BNERGY TOTAL UNIT OU	G NO: LOAD: LOAD: TION MODI EMAND: MPTION: COST: COST: COST:	iT:	29005 836 0 EQ-2S 485.7 941073 \$74,118 \$22,586 \$96,704 \$116 ANNUAL OCCUR	KW KWHYR AYR AYR AYR ATONIYR	COMPRI CONDET REFRIGI STATUS CONFIG MAX LE/ LOAD LI RATED ( RATED )	ESSOR: NSER: ERANT: : URATION AD SETPT MIT: CAPACITY POWER: EFFICIEN	cy:	RATE LO.		CENT WATER R-123 NEW SERIES/S 95 426.6 247.8 0.581 ANNUAL OCCUR	INGLE % TONS KW KW/TON I	COMPRE CONDEN REFRIGE STATUS: CONFIGI MIN LAG LOAD LII RATED C RATED C	ESSOR: ISSER: ERANT: : URATION I SETPOINMIT: CAPACIT OWER: EFFICIEN RAT	NT: Y: CY: RAT	% RAT	POWER	CENT WATER R-123 NEW SERIES/5 70 100 426.6 247.8 0.581 ANNUAL OCCUR	TONS KW KW/TON ANNUAL SHERGY
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	BULDIN DESIGN WINTER SIMULA* PEAK DI CONSUN DEMANI BNERGY TOTAL ( UNIT OU PLANT DSGN LOAD	G NO: LOAD: LOAD: FION MODI BHAND: APTION: O COST: O COST: O COST: O COST: O COST: O COST:	PLANT LOAD SHED	29005 836 0 EG-25 485.7 941073 \$74,118 \$22,586 \$96,704 \$116 ANNUAL OCCUR ACTUAL	KW KWHYR //R //R //R //R //R //R //R //R //R /	COMPRICONDER REFRIGI STATUS CONFIG MAX LE/ LOAD LI RATED ( RATED ( RATED ( CHL LOAD	ESSOR: VSER: ERANT: : URATION AD SETPT MIT: CAPACIT POWER: EFFICIEN RAT CAP ACT	CY:	RATE LO. % RAT POW	POWER	CENT WATER R-123 NEW SERIES/S 95 95 426.8 247.8 0.581 ANNUAL OCCUR ADJUST	NOLE % TONS KW KWITON ANNUAL ENERGY CONSUMP	COMPRECONDEN REFRIGE STATUS: CONTENION MN LAG LOAD LE RATED C RATED C RATED C RATED C RATED C RATED LOAD	ESSOR: ISER: ERANT: : URATION ISETPOI MIT: CAPACIT POWER: EFFICIEN RAT CAP ACT	Y: CY: RAT CAP ADJ	5% RAT POW		CENT WATER R-123 NEW SERIES/7 70 100 428.8 247.8 0.581 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL SENERGY CONSUMP
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Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

PE ANT NO.										
PLANT NO:		19		MASTER	CHILLER	NO (LEA	D):		28	
BUILDING NO:		31008	TONS	COMPRE	eens.				SCREW	W/ TURBO
DESIGN LOAD: WINTER LOAD:		458 0	*DEGN	CONDEN					WATER	*** *******
SIMULATION MODE		EQ-1		REFRIGE					R-22	
			i	STATUS:					EXISTING	
PEAK DEMAND:		289.0	KW						-	
CONSUMPTION:		507623	KWHYR I	CONFIGU MAX LEA		000 6	ATELOA	D-	SINGLE NA	*
		\$44,101	Λ/R	LOAD LIN		or PNO-P	MIELOA	i.	96	~
DEMAND COST: ENERGY COST:		\$12,183	MR I	LOAD LIN					• • •	
TOTAL COST:		\$56,284	MR I	RATED C		:			460.0	TONS
			j	RATED P					301.0	KW
UNIT OUTPUT COST	;	\$129	/TONYR	RATED E	FFICIENC	Y:			0.654	KW/TON
		********	PLANT I	CHIL	- %	%	%	POWER	ANNUAL	ANNUAL
% PLANT	PLANT LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	BAT	ronen	OCCUR	ENERGY
PLANT LOAD DSGN	SHED	ACTUAL	DEMAND	LOAD	CAP	CAP	POW		ADJUST	CONSUMP
LOAD	SHED	AGTORE	i		ACT	ADJ				
LOAD			i							
% TONS	TONS	HRYR	KW	TONS	%	*	*	KW	HR/YR	KWHYR
0W 0.0	0.0	4380	0.0	0.0	0	0	0	0.0	0	0
3 5 13.7	0.0	37	6.0	13.7	3	15	2	6.0	7	42
8 5 38.6	0.0	50	6.0	36.6		15	2	6.0	27	182
13 \$ 59.5	0.0	65	6.0	59.5	13	15	2	6.0	56	336 747
18 S 82.4	0.0	83	9.0	82.4 105.3	18 23	18 23	3 5	9.0 15.1	83 106	1601
23 \$ 105.3	0.0	106 143	15.1   24.1	105.3 128.2	28	23 28	å	24.1	143	3448
28 \$ 128.2	0.0 0.0	184	33.1	151.1	33	33	11	33.1	184	6090
33 S 151.1 38 S 174.0	0.0	232	45.2	174.0	38	38	15	45.2	232	10486
43 S 196.9	0.0	259	57.2	196.9	43	43	19	57.2	259	14815
48 S 219.8	0.0	292	72.2	219.8	48	48	24	72.2	292	21082
53 5 242.7	0.0	343	87.3	242.7	53	53	29	87.3 105.4	343	29944 40157
58 S 265.6	0.0	381	105.4	265.6	58 83	58 83	35 42	105.4 126.4	381	49043
63 S 288.5	0.0	388 374	126.4	288.5 311.4	68	68	49	147.5	374	55185
68 S 311.4 73 S 334.3	0.0	3/4	168.6	334.3	73	73	56	168.6	357	60190
78 S 357.2	0.0	308	195.7	357.2	78	78	65	195.7	308	60276
83 5 380.1	0.0	247	219.7	380.1	83	83	73	219.7	247	54266
88 S 403.0	0.0	171	249.8	403.0	88	88	83	249.8	171	42716
93 S 425.9	0.0	109	276.9	425.9	93	93 95	92	276.9 289.0	109 59	30182 17051
98 5 448.8	11.8	59	289.0   289.0	437.0 437.0	95 95	95 95	96	289.0	25	7225
103 S 471.7 108 S 494.6	34.7 57.6	25 7	289.0	437.0	95	95	96	289.0	7	2023
108 S 494.6 113 S 517.5	80.5	ź	289.0	437.0	95	95	98	289.0	2	578
118 S 540.4	103.4	õ	289.0	437.0	95	95	96	289.0	0	0
1100 000	100.4		200.0	437.0	•					
1100 0102	100.4	8602	200.0	437.0					4160	507623
		8602							4160	507623
										507623
PLANT NO:		20			CHILLER	NO (LEA			4160	507623
PLANT NO: BUILDING NO:		20 34008		MASTER	CHILLER	NO (LEA				507623 W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD:		20	TONS %DSGN	MASTER COMPRE CONDEN	CHILLER	NO (LEA			29 SCREW WATER	
PLANT NO: BUILDING NO:		20 34008 485	TONS	MASTER COMPRE CONDEN REFRIGI	CHILLER ESSOR: ISER: ERANT:	NO (LEA	ND):	as parameters of	29 SCREW WATER R-22	W/ TURBO
PLANT NO: BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE		20 34008 485 0 EQ-1	TONS %DSGN	MASTER COMPRE CONDEN	CHILLER ESSOR: ISER: ERANT:	NO (LEA			29 SCREW WATER	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND:		20 34008 485 0 EQ-1	TONS %DSGN	MASTER COMPRE CONDEX REFRIGI STATUS:	CHILLER ESSOR: ISER: ERANT:		AD):		29 SCREW WATER R-22 EXISTING	W/ TURBO
PLANT NO: BUILDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE		20 34008 485 0 EQ-1	TONS %DSGN	MASTER COMPRE CONDEN REFRIGI STATUS:	CHILLER ESSOR: ISER: ERANT:			AD-	29 SCREW WATER R-22 EXISTING	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION:		20 34008 485 0 EQ-1 289.0 581689	TONS %DSGN	MASTER COMPRE CONDEN REFRIGI STATUS: CONFIGI	CHILLER ESSOR: ISER: ERANT: : URATION			AD:	29 SCREW WATER R-22 EXISTING	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST:		20 34008 485 0 EQ-1 289.0 581689	TONS %DSGN	MASTER COMPRE CONDEN REFRIGI STATUS:	CHILLER ESSOR: ISER: ERANT: : URATION			AD:	SCREW WATER R-22 EXISTING SINGLE NA 95	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION:		20 34008 485 0 EQ-1 289.0 581689	TONS %DSGN	MASTER COMPRE CONDEA REFRIGI STATUS: CONFIGI MAX LEA LOAD LII	CHILLER ESSOR: ISER: ERANT: :: URATION AD SETPT MIT: CAPACITY	or PRO-		 	29 SCREW WATER R-22 EXISTING SINGLE NA 95	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST: BNERGY COST: TOTAL COST:		20 34008 495 0 EQ-1 289.0 561689 344,101 \$13,461 \$57,582	TONS %DSGN KW KWH/YR MR MR MR MR MR	MASTER COMPRE CONDEN REFRIGI STATUS: CONFIGI MAX LEA LOAD LI RATED ( RATED 6	CHILLER ESSOR: ISER: ERANT: : URATION AD SETPT MIT: CAPACITY POWER:	or PRO-			29 SCREW WATER R-22 EXISTING SINGLE NA 95 460.0 301.0	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST: BUERGY COST:		20 34008 485 0 EQ-1 289.0 581689 \$44,101 \$13,481	TONS %DSGN	MASTER COMPRE CONDEN REFRIGI STATUS: CONFIGI MAX LEA LOAD LI RATED ( RATED 6	CHILLER ESSOR: ISER: ERANT: :: URATION AD SETPT MIT: CAPACITY	or PRO-		AD:	29 SCREW WATER R-22 EXISTING SINGLE NA 95	W/ TURBO
PLANT NO: BULDING NO: DESIGN LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST: BNERGY COST: TOTAL COST:	T:	20 34008 485 0 EQ-1 289.0 551889 \$44,101 \$13,481 \$57,582 \$132	TONS %LDSGN  KW KWH/YR /YR /YR /YR /TON'YR	MASTER COMPRE CONDEN REFRIGIO STATUS: CONFIGI MAX LE/ LOAD LII RATED 0 RATED 1 RATED 1 RATED 1	CHILLER ESSOR: ISER: ERANT: URATION AD SETPT MIT: CAPACITY POWER: EFFICIEN	or PRO-	RATE LO	AD:	29 SCREW WATER R-22 EXISTING SINGLE NA 95 460.0 301.0 0.854	W/ TURBO % % TONS KW KW/TON
PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST: BNERGY COST: TOTAL COST: UNIT OUTPUT COS PLANT PLANT LOAD	T:	20 34008 495 0 EQ-1 289.0 581689 \$44,101 \$13,481 \$57,582 \$132 ANNUAL	TONS %DSGN  KW KWHYR  //R  //R  //TON*YR	MASTER COMPRIS CONDEN REFRIGI STATUS CONFIGI MAX LEA LOAD LII RATED 0	CHILLER ESSOR: ISER: ISERNT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: ISERANT: I	or PRO-	RATE LO		29 SCREW WATER R-22 EXISTING SINGLE NA 95 480.0 301.0 0.854 ANNUAL OCCUR	W/ TURBO
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PLANT NO: BULDING NO: DESIGN LOAD: WINTER LOAD: SIMULATION MODE PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: TOTAL COST: UNIT OUTPUT COS  W	T:  PLANT LOAD SHED  TONS  0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	200 34003 485 50 EG-1 289.0 581889 \$44,101 \$13,481 \$57,582 ANNUAL OCCUR ACTUAL HR/YR 4380 65 83 106 143 184 232 2599 292 343 331 388 374 2577 508 2477 1711 100 59 257	TONS %LDSGN KW KWHYR MR MR MR MR MR MR MR MR MR MR MR MR MR	MASTER COMPRES CONDEN REFRIGI STATUS: CONFIGI MAX LEF LOAD LI RATED I RATED I TONS 1 0.0 14.8 23.8 23.8 23.8 111.8 135.4 135.4 135.4 135.4 143.0 1437.0 1437.0 1437.0 1437.0 1437.0	CHILLER SSOR: SER: SER: URATION D SETPT WATTON OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT ACT OUT SETPT A	7: or PRO- 7: CCY:	% RATE LO % RAT POW % 0 2 2 2 3 3 8 9 9 13 13 17 12 17 23 33 39 46 65 65 65 65 65 65 65 65 65 65 65 65 65	0.0 6.0 6.0 6.0 9.0 18.1 27.1 39.1. 27.1 39.3 117.4 138.5 189.6 213.7 249.8 278.9 289.0 289.0 289.0	29 SCREW WATER R-22 EXISTING SINGLE NA 95 460.0 301.0 0.854 ANNUAL OCCUR ADJUST HRAYR 0 7 61 83 31 184 222 259 222 343 381 388 374 357 308 247 171 100 50 25 7 2	W/ TURBO  %  TONS KW TONS KW/TON  ANNUAL ENERGY CONSUMP  16: 36: 36: 74 19: 387: 719: 1856: 2374 3406 4472

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

PLANT N BUILDIN DESIGN WINTER SIMULAT	3 NO: LOAD:	EL:	21 36000 1155 20 EQ-3	TONS %DSGN	COMPRI COMPRI CONDET REFRIG STATUS	SER: ERANT:	R NO (LE	AD):		CENT WATER R-123 NEW	W/ TURBO	COMPRI CONDEN	ISER: ERANT:	NO (LA	3 1):		30 CENT WATER R-123	
PEAK DE			731.7 1644885	KW KW-VYR	CONFIG	URATION		RATE LO	AD:	PARALLE 85	*		: URATION SETPOR				PARALLE NA	ı. *
DEMAND			\$111,657 \$39,477	Λ'R Λ'R	LOAD LI					95	%	LOAD LI		•••			100	×
TOTAL C	OST:		\$151,135	ΛΑ	RATED (	CAPACITY	<b>/</b> :			425.7 247.2	TONS	RATED O	CAPACITY	<b>/</b> :			425.7 247.2	TONS KW
UNIT OU	TPUT COS	T:	\$120	/TONTYR	RATED	EFFICIEN	CY:			0.581	KW/TON		FFICIEN	CY:			0.581	KW/TON
% PLANT DSGN LOAD	PLANT LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	CHIL	% RAT CAP ACT	% RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL BNERGY CONSUMP	CHIL LOAD	RAT CAP ACT	% RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
*	TONS	TONS	HRYR	ĸw	TONS	*	%	%	KW	HRYR	KWHYR	TONS	%	%	%	ĸw	HAYR	KWHYR
20 W	231.0	0.0	4380	74.2	231.0	54	54	30	74.2	4380	324996	0.0	0			0.0	0	
3 \$	34.7	0.0	37	4.9	34.7	8	15	2	4.9	20	98	0.0	0	0	0	0.0	0	
8 \$	92.4	0.0	50	12.4	92.4	22	22	5	12.4	50	620	0.0	0	٥	0	0.0	0	
13 S	150.2	0.0	85	32.1	150.2	35	35	13	32.1	65	2087	0.0	0	0	0	0.0	0	
18 S	207.9 265.7	0.0	83	61.8	207.9	49	49	25	61.8	83	5129	0.0	0	0	0	0.0	0	
28 S	323.4	0.0	106	101.4	265.7 323.4	62 76	82 78	41 61	101.4	106 143	10748	0.0	0	0	0	0.0	0	
33 S	381.2	0.0	184	143.3	185.7	44	44	20	49.4	184	21584   9090	0.0 195.5	45	46	0 38	93.9	184	4707
34 5	434.9	0.0	232	173.1	213.8	50	50	28	64.3	232	14918	225.1	53	53	44	108.8	232	1727 2524
43 S	498.7	0.0	259	210.1	242.0	57	57	34	84.0	259	21758	254.7	60	60	51	126.1	259	3286
48 S	554.4	0.0	292	247.2	270.1	63	63	42	103.8	292	30310	284.3	67	67	58	143.4	292	4187
53 S	812.2	0.0	343	289.2	298.3	70	70	52	128.5	343	44076	313.9	74	74	65	160.7	343	5512
58 S	669.9	0.0	381	338.6	326.4	77	77	63	155.7	381	59322	343.5	81	81	74	182.9	381	696
<b>63</b> S	727.7	0.0	388	318.8	234.3	55	55	31	76.6	388	29721	246.7	58	58	49	121.1	388	4898
68 S	785.4	0.0	374	356.0	252.9	59	59	36	89.0	374	33286	266.2	83	53	54	133.5	374	4992
73 S	843.2	0.0	357	393.1	271.5	64	64	43	108.3	357	37940	285.8	67	67	58	143.4	357	5119
78 5	900.9	0.0	308	432.5	290.1	68	68	49	121.1	308	37299	305.4	72	72	63	155.7	308	4795
83 S	958.7	0.0	247	474.6	308.7	73	73	56	138.4	247	34185	325.0	76	78	68	168.1	247	4152
88 \$	1016.4	0.0	171	521.5	327.3	77	77	63	155.7	171	26625	344.5	81	81	74	182.9	171	3127
93 S 98 S	1074.2	0.0 0.0	109 59	568.6 615.5	345.9 384.5	81 86	81 86	70 79	173.0 195.3	109 59	18857	384.1	86	86	80	197.8	109	2150
103 5	1189.7	0.0	25	689.9	384.5	86 90	90	79 87	195.3 215.1	59 25	11523   5378	383.7 403.3	90 95	90 95	85 92	210.1	59	1239
108 5	1247.4	0.0	7	717.0	401.7	94	94	94	232.4	7	1627	422.8	99	96	92	227.4 242.3	25	568
113 5	1305.2	49.4	2	731.7	404.4	95	95	96	237.3	2	475	425.7	100	100	100	242.3	,	169
118 S	1382.9	107.1	ō	731.7	404.4	95	95	98	237.3	ō	70	425.7	100	100	100	247.2	6	41
			8602							8585	781639						3738	55255

PLANT N			22 36006	!	MASTER	CHILLE	NO (LE	AD):		33	
DESIGN			259	TONS	COMPRI	ESSOR:				CENT	W/ TURBO
WINTER			0	%DSGN I	CONDE					WATER	*** 101180
SIMULAT	TON MOD	EL:	EQ-1		REFRIG					R-123	
				i	STATUS					NEW	
PEAK DE			180.0	KW I	0011510						
CONSUM	APTION:		280142	KWHYR		URATION OD SETP		D47510	40	SINGLE	
DEMAND	COST		\$27,468	Λ⁄R ¦	LOAD LE		or PHQ-	KATELO	AU:	NA 95	%
ENERGY			\$8,723	MB I	COAD LA	WITT.				90	74
TOTAL C			\$34,191	Λ/R	BATED	CAPACIT	٧٠			275.0	TONS
			•••,,,••		BATED		•			187.5	KW
UNITOU	TPUT COS	ST:	\$131	TONTYR	RATED	EFFICIEN	CY:			0.682	KW/TON
1 %	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	~~.	~ %	POWER	ANNUAL	ANNUAL
PLANT	LOAD	LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY
DSGN		SHED	ACTUAL	i		CAP	CAP	POW		ADJUST	CONSUMP
LOAD				!		ACT	ADJ				
*	TONS	TONS	HRYR	kw	TONS	%	%	%	KW	HR/YR	KWHYR
l ow	0.0	0.0	4380	0.0 [	0.0			0	0.0	0	0
3 5	7.8	0.0	37	3.8	7.8	3	15	2	3.8	7	27
85	20.7	0.0	50	3.8	20.7	8	15	2	3.8	27	103
135	33.7	0.0	65	3.8	33.7	12	15	2	3.8	52	198
185	46.6	0.0	83	5.6	46.6	17	17	3	5.6	83	485
23 \$	59.8	0.0	108	9.4	59.6	22	22	5	9.4	106	996
28 5	72.5	0.0	143	13.1	72.5	26	26	7	13.1	143	1873
33 5	85.5	0.0	184	18.8	85.5	31	31	10	18.8	184	3459
38 5	98.4	0.0	232	24.4	98.4	38	36	13	24.4	232	5661
43 S	111.4	0.0	259	31.9	111.4	41	41	17	31.9	259	8262
535	124.3 137,3	0.0 0.0	292 343	39.4	124.3	45	45	21	39.4	292	11505
53.5   58.5	150.2	0.0	343	48.8   58.1	137.3 150.2	50 55	50 55	26 31	48.8	343	18738
635	163.2	0.0	388	87.5	183.2	59	59	36	58.1 67.5	381 388	22136 26190
685	176.1	0.0	374	80.6	176.1	64	64	43	80.6	374	30144
73 \$	189.1	0.0	357	93.8		69	89	50	93.8	357	33487
78 5	202.0	0.0	308	105.0	202.0	73	73	58	105.0	308	32340
83.5	215.0	0.0	247	121.9		78	78	65	121.9	247	30109
88.5	227.9	0.0	171	138.9	227.9	83	83	73	138.9	171	23410
935	240.9	0.0	109	155.6	240.9	88	88	83	155.8	109	16960
98 \$	253.8	0.0	59	168.8	253.8	92	92	90	168.8	59	9959
103 5	266.8	5.5	25	180.0	261.3	95	95	96	180.0	25	4500
108 S	279.7	18.4	7	180.0	261.3	95	95	98	180.0	7	1260
113 5	292.7	31.4	2	180.0	261.3	95	95	98	180.0	2	360
118 S	305.6	44.3	0	180.0	261.3	95	95	82	180.0	0	0
			8602							4158	280142

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

PLANT NO: BUILDING NO:		25 39015			CHILLER	NO (LE	AD):		38		MASTER		NO (LAC	3 1):		37	
DESIGN LOAD: WINTER LOAD: SIMULATION MODE	EL:	980 0 EQ-2S	TONS %DSGN	COMPRI CONDEN REFRIGI STATUS	SER: ERANT:				CENT WATER R-123 NEW	W/ TURBO	COMPRE CONDEN REFRIGE STATUS:	ISER: ERANT:				CENT WATER R-123 NEW	
PEAK DEMAND: CONSUMPTION: DEMAND COST:		569.0 1122680 \$86,829	KWHYR /YR		URATION AD SETPT MIT:		RATE LO	AD:	SERIES/S 85 98	SNGLE	CONFIGI MIN LAG LOAD LI	SETPOR				SERIES/S 70 100	SNOLE % %
ENERGY COST: TOTAL COST:		\$26,944 \$113,774	∧'R ∧'R	RATED (	CAPACITY POWER:				490.0 290.3	TONS KW	RATED C	OWER:				490.0 290.3	TONS KW
UNIT OUTPUT COS		\$119	/TONTYR		EFFICIEN	<del></del> -			0.592	KW/TON	RATED E					0.592	KW/TON
% PLANT PLANT LOAD DSGN LOAD	PLANT LOAD SHED	OCCUR ACTUAL	DEMAND	LOAD	RAT CAP ACT	% RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ENERGY CONSUMP	LOAD	% RAT CAP ACT	RAT CAP ADJ	RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUM
% TONS	TONS	HR/YR	KW	TONS	*	*	_*	KW	HRYR	KWHYR	TONS	*	*	<b>%</b>	KW .	HR/YR	KWHYR
0W 0.0 3 5 29.4 8 5 78.4 13 S 127.4 18 S 178.4 23 5 225.4 28 S 274.4	0.0 0.0 0.0 0.0 0.0 0.0	4380 37 50 65 83 106 143	0.0 5.8 5.8 20.3 37.7 63.9 95.8	0.0 29.4 78.4 127.4 176.4 225.4 274.4	0 8 18 26 36 48 56	0 15 18 26 38 46 58	0 2 7 13 22 33	0.0 5.8 5.8 20.3 37.7 63.9 95.8	0 15 50 65 83 108 143	0   87   290   1320   3129   6773   13699	0.0 0.0 0.0 0.0 0.0 0.0	0000	0 0 0 0	0	0.0 0.0 0.0 0.0 0.0 0.0	0 0 0 0 0	
33 S 323.4 38 S 372.4 43 S 421.4 48 S 470.4	0.0 0.0 0.0 0.0	184 232 259 292	133.5 177.1 182.9 197.4	323.4 372.4 78.4 127.4	66 76 16 28	66 76 16 26	46 61 2 7	133.5 177.1 5.8 20.3	184 232 259 292	24584   41087   1502   5928	0.0 0.0 343.0 343.0	0 0 70 70	0 70 70	0 61 61	0.0 0.0 177.1 177.1	0 259 292	4584 517
53 S 519.4 58 S 568.4 63 S 617.4 68 S 666.4	0.0 0.0 0.0	343 381 388 374	214.8 241.0 272.9 310.6	178.4 225.4 274.4 323.4	38 48 58 68	36 46 56 66	13 22 33 48	37.7 83.9 95.8 133.5	343 381 388 374	12931   24346   37170   49929	343.0 343.0 343.0 343.0	70 70 70 70	70 70 70 70	61 61 61	177.1 177.1 177.1 177.1	343 381 388 374	6074 6741 687 682
73 \$ 715.4 78 \$ 764.4	0.0	357 308	354.2 380.3	372.4	78 71	78 71	61 53	177.1	357 308	63225   47401	343.0 416.5	70 85	70 85	61 78	177.1 226.4	357 308	632
83 S 813.4 88 S 862.4	0.0	247 171	429.6 467.4	398.9 372.4	81 76	81 76	70 61	203.2 177.1	247 171	50190   30284	416.5	85 100	85 100	78 100	228.A 290.3	247 171	559 496
93 S 911.4 98 S 960.4	0.0	109 59	519.6 569.0	421.4 465.5	86 95	86 95	79 96	229.3 278.7	109 59	24994   16443	490.0 490.0	100 100	100 100	100 100	290.3 290.3	109 59	316 171
103 S 1009.4 108 S 1058.4 113 S 1107.4	53.9 102.9 151.9	25 7 2	569.0 569.0 569.0	465.5 465.5 465.5	95 95	95 95 95	96 96 96	278.7 278.7 278.7	25 7 2 0	6968   1951   557	490.0 490.0 490.0 490.0	100 100 100	100 100 100 100	100 100 100	290.3 290.3 290.3	25 7 2 0	72 20 5
118 \$ 1158.4	200.9	8602	589.0	485.5	95	95	96	278.7	4200	0   	490.0	100	100	100	2903	3322	6579
<del></del>				·													
LANT NO:		26 39043		MASTER	CHILLER	NO (LE	AD):		40	· [	MASTER		NO (LA	3 1):		39	
DESIGN LOAD: VINTER LOAD: SIMULATION MODI	EL:	1084 0 EQ-2S	TONS *LDSGN	COMPRI	NSER: ERANT:				WATER R-123	W/TURBO	COMPRE					WATER	
EAK DEMAND:				SINIUS	6				NEW		STATUS					R-123 NEW	
CONSUMPTION		874.8 1282336	KW KWH/YR	CONFIG MAX LEA	URATION AD SETPT		RATELO	AD:	NEW SERIES/S	<b>%</b>	CONFIGI MIN LAG	URATION SETPOR				NEW SERIES/S 70	%
DEMAND COST: DEMAND COST: ENERGY COST: TOTAL COST: JUIT OUTPUT COS		674.6		CONFIG MAX LE/ LOAD LI RATED (	URATION AD SETPT MIT: CAPACITY	or PRO- /:	RATELO	AD:	NEW SERIES/S		CONFIG	URATION SETPOR MIT: CAPACITY POWER:	it: /:			NEW SERIES/S	% TONS
DEMAND COST: ENERGY COST: OTAL COST: INIT OUTPUT COS  PLANT LOAD ISGN	PLANT LOAD SHED	874.8 1282336 \$102,944 \$30,776 \$133,720	KWH/YR /YR /YR /YR	CONFIG MAX LE/ LOAD LI RATED (	URATION AD SETPT MIT: CAPACITY POWER:	or PRO- /:	RATE LO	POWER	NEW SERIES/S 85 95 580.0 344.2	% TONS	CONFIGURATION LAGE LOAD LING RATED CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTO	URATION SETPOR MIT: CAPACITY POWER:	it: /:	% RAT POW	POWER	NEW SERIES/S 70 100 560.0 344.2	% TONS
EMAND COST: NERGY COST: OTAL COST: NIT OUTPUT COS PLANT LANT LOAD ISON OAD	PLANT	874.8 1282336 \$102,944 \$30,778 \$133,720 \$122 ANNUAL OCCUR	XWHYR  YR  YR  YR  YTONYR  PLANT	CONFIGURAL LOAD LI	URATION AD SETPT MIT: CAPACITY POWER: EFFICIENCE RAT CAP	CY:			SERIES/S 85 95 580.0 344.2 0.815 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY	STATUS: CONFIGI MIN LAG LOAD LII RATED C RATED E CHIL	URATION SETPOR MIT: CAPACITY POWER: EFFICIEN SAPACITY POWER: FAT CAP	CY:	RAT	POWER	SERIES/5 70 100 560.0 344.2 0.615 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY CONSUM
EMAND COST: NERGY COST: NITO OUTPUT COS INITO OUTPUT COS	PLANT LOAD SHED TONS 0.0 0.0 0.0 0.0	874.8 1282336 \$102,944 \$30,776 \$133,720 \$122 ANNUAL OCCUR ACTUAL HRVR 4380 37 50 85	KWHYR  YR  YR  YR  YR  YR  ITONYR  PLANT DEMAND  KW  0.0 6.9 6.9 20.7 44.7	CONFIGURATION OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE 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Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

BUILDING NO:		27 41003		MASTER	CHILLE	NO (LE	AD):		41	
DESIGN LOAD: WINTER LOAD: SIMULATION MOD	EL:	232 0 EQ-1	TONS NDSGN	COMPRI CONDEN REFRIGI STATUS	ISER: ERANT:				CENT WATER R-123 NEW	W/ TURBO
PEAK DEMAND: CONSUMPTION: DEMAND COST:		151.1 275440	KW KWH/YR	MAX LE			RATELO	AD:	SINGLE NA	*
ENERGY COST: TOTAL COST:		\$23,058 \$6,611 \$29,688	AYR AYR AYR	LOADLI	MIT: CAPACIT	<b>/</b> :			95 227.5	% TONS
UNIT OUTPUT COS	ST:	\$137	/TONEYR	RATED					157.4 0.892	KW KW/TON
% PLANT PLANT LOAD DSGN LOAD	PLANT LOAD SHED	ANNUAL OCCUR ACTUAL	PLANT DEMAND	LOAD	% RAT CAP ACT	RAT CAP ADJ	% RAT POW	POWER	ANNUAL OCCUR ADJUST	ANNUAL ENERGY CONSUMP
% TONS	TONS	HR/YR	ĸw	TONS	%	%	%	KW	HRYR	KWHYR
0W 0.0 3 S 7.0	0.0	4380 37	0.0 3.1	0.0 7.0	0	0	0 2	0.0 3.1	0 7	22
8 S 18.6	0.0	50	3.1	18.6	8	15	2	3.1	27	84
13 S 30.2 18 S 41.8	0.0	65 83	3.1 4.7	30.2 41.8	13 18	15	2	3.1 4.7	56 83	174 390
23 S 53.4	0.0	106	7.9	53.4	23	23	5	7.9	106	837
28 S 85.0 33 S 76.6	0.0	143 184	14.2 18.9	85.0 76.6	29 34	29 34	12	14.2 18.9	143	2031 3478
38 5 88.2	0.0	232	25.2	88.2	39	39	16	25.2	232	5846
43 S 99.8 48 S 111.4	0.0	259 292	31.5 39.4	99.8 111.4	44	44	20 25	31.5 39.4	259 292	8159 11505
53 S 123.0	0.0	343	47.2	123.0	54	54	30	47.2	343	16190
58 S 134.6 63 S 146.2	0.0	381 388	58.7 67.7	134.6 146.2	59 64	59 64	36 43	58.7 67.7	381 388	21603 26268
68 S 157.8	0.0	374	78.7	157.8	69	69	50	78.7	374	29434
73 S 169.4 78 S 181.0	0.0 0.0	357 308	91.3 107.0	189,4 181,0	74 80	74 80	58 68	91.3 107.0	357 308	32594 32958
83 S 192.6	0.0	247	121.2	192.6	85	85	77	121.2	247	29938
88 S 204.2 93 S 215.8	0.0 0.0	171 109	136.9 ( 151.1	204.2 215.8	90 95	90 95	87 96	136.9 151.1	171 109	23410 18470
98 S 227.4	11.3	59	151.1	218.1	95	95	96	151.1	59	8915
103 S 239.0 108 S 250.6	22.9 34.5	25 7	151.1 151.1	216.1 216.1	95 95	95 95	98 98	151.1 151.1	25 7	3778 1058
113 S 262.2 118 S 273.8	46.1	2	151.1	218.1	95 95	95 95	95 96	151.1	2	302
118 5 273.8	57.7	8602	151.1	216.1	90	95	90	151.1	4160	275440
PLANT NO: BUILDING NO:		30 50004		MASTER	CHILLER	NO (LE	ND):		44	
DESIGN LOAD:		306	TONS	COMPRE	SSOR:					W/ TURBO
WINTER LOAD: SIMULATION MODI		20							CENT	
	EL:	EQ-1	%DSGN	CONDEN	RANT:				WATER R-123	
PEAK DEMAND:	EL:	EQ-1 190.1 368478	KW KWHYR	CONDEN REFRIGE STATUS: CONFIGU	RANT:				WATER R-123 NEW SINGLE	
PEAK DEMAND: CONSUMPTION: DEMAND COST:	EL:	190.1 368478 \$29,009	KW KWHYR	CONDEN REFRIGE STATUS:	RANT: JRATION D SETPT		RATELO	AD:	WATER R-123 NEW	* *
PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST:	EL: 	190.1 368478	KWH/YR	CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIN	PRANT:  JRATION: D SETPT  AIT:  PAPACITY	or PRO-	RATE LO	AD:	WATER R-123 NEW SINGLE NA 95	% % TONS
PEAK DEMAND: CONSUMPTION; DEMAND COST: ENERGY COST: TOTAL COST:	-	190.1 368478 \$29,009 \$8,843	KW KWHYR MR	CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LIN	PRANT:  JRATION: D SETPT  AIT:  CAPACITY OWER:	or PRO-	RATELO	AD:	WATER R-123 NEW SINGLE NA 95	* *
PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: FOTAL COST: UNIT OUTPUT COS W. PLANT	FLANT	190.1 368478 \$29,009 \$8,843 \$37,853 \$130 ANNUAL OCCUR	KW KWHYR MR MR	CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LE RATED O RATED F	JRATION: D SETPT AIT: CAPACITY OWER: FFICIENC	cy:	% BAT	AD: POWER	WATER R-123 NEW SINGLE NA 95 308.0 198.0 0.647 ANNUAL OCCUR	TONS KW KW/TON ANNUAL ENERGY
PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: OTAL COST: UNIT OUTPUT COS  PLANT PLANT LOAD DSGN	ST:	190.1 368478 \$29,009 \$8,843 \$37,853 \$130	KW KWHYR  WR  YR  YR  YR  TON'YR	CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LB RATED C RATED F RATED E CHIL	PRANT:  JRATION: D SETPT  AIT:  APACITY OWER: FFICIENCY	or PRO-			WATER R-123 NEW SINGLE NA 95 308.0 198.0 0.647 ANNUAL	* TONS KW KW/TON
PEAR DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: FOTAL COST: UNIT OUTPUT COS PLANT PLANT PLANT LOAD JOSGN JOAC TONS	PLANT LOAD SHED TONS	190.1 368478 \$29,009 \$6,843 \$37,853 \$130 ANNUAL OCCUR ACTUAL HR/YR	KW KWHYR  MR MR MR MR MR MR MR MR MR MR MR MR M	CONDEN REFRIGE STATUS: CONFIGU MAX LEA LOAD LB RATED C RATED C RATED E CHIL LOAD TONS	JRATION D SETPT AIT: APACITY OWER: FFICIENC RAT CAP ACT	CY:  RAT CAP ADJ	% BAT	POWER	WATER R-123 NEW SINGLE NA 95 306.0 198.0 0.647 ANNUAL OCCUR ADJUST	TONS KW KW/TON ANNUAL BNERGY CONSUMP
PEAK DEMAND: CONSUMPTION: DEMAND COST: ENERGY COST: FOTAL COST: JINIT OUTPUT COS  K. PLANT PLANT LOAD DISGN LOAD	PLANT LOAD SHED	190.1 368478 \$29,009 \$8,843 \$37,853 \$130 ANNUAL OCCUR ACTUAL	KW KWHYR KWHYR MR MR MR MR MR MR MR MR MR MR MR MR MR	CONDEN REFRIGE STATUS: CONFIGUE MAX LEA LOAD LB RATED C RATED C RATED C RATED C RATED C LOAD	PRANT:  JRATION: D SETPT AIT:  APACITY OWER: FFICIENC  RAT CAP ACT	CY:  RAT CAP ADJ	% RAT POW	POWER	WATER R-123 NEW SINGLE NA 95 308.0 198.0 0.847 ANNUAL OCCUR ADJUST	% % TONS KW KW/TON ANNUAL ENERGY CONSUMP KWHYR 34602
PEAK DEMAND: CONSUMPTION: DEMAND COST: DIFFINE PROPOST: DIFFINE PROPOST: DIFFINE PROPOST: WHIT OUTPUT COST: WHIT OUTPUT COST: WHIT OUTPUT COST: A PLANT HANT LOAD SIGN OAD 4 TONS 20W 81.2 3.5 9.2 8.5 24.5	PLANT LOAD SHED TONS	190.1 368478 \$29,009 \$8,843 \$37,853 \$130 ANNUAL OCCUR ACTUAL HRYR 4380 37 50	KW KWHYR  //R //R //R //R //TON'YR  PLANT DEMAND  KW  7.9 4.0 4.0	CONDEN REFRIGE STATUS: CONFIGI MAX LEA LOAD LB RATED E RATED E CHL LOAD TONIS 612 92 24.5	PRANT:  URATION D SETPT AIT:  APACIT:  CAPACIT:  RAT CAP ACT  20 3 8	% PRO-	% RAT POW	POWER  KW  7.9 4.0 4.0	WATER R-123 NEW SNGLE NA 95 306.0 198.0 0.647 ANNUAL OCCUR ADJUST HRV'R 4380 7	TONS KW KW/TON ANNUL ENERGY CONSUMP KWH/YR 34602 28 108
PEAK DEMAND: CONSUMPTION: DEMAND COST: FOTAL COST: UNIT OUTPUT COS  K PLANT LOAD DISGN OAD  TONS  20W 61.2 3 S 9.2	PLANT LOAD SHED TONS	190.1 368478 \$29,009 \$8,843 \$37,853 \$130 ANNUAL OCCUR ACTUAL HR/YR	KW KWHYR KWHYR MR MR MR MR MR MR MR MR MR MR MR MR MR	CONDEN REFRIGE STATUS: CONFIGI MAX LEA LOAD LB RATED F RATED F RATED E RATED D RATED D	PRANT:  URATION D SETPT AIT:  PAPACITY OWER:  FFICIENCY  RAT  CAP  ACT  20 3	% RAT CAP ADJ %	% RAT POW %	POWER  KW  7.9 4.0	WATER R-123 NEW SNGLE NA 95 306.0 198.0 0.647 ANNUAL OCCUR ADJUST HRYR 4380 7	TONS KW KW/TON ANNUL ENERGY CONSUMP KWH/YR 34602 28 108
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PLANT PLANT LOAD DSSGN .OAD  TONS  20W 612 3 \$ 92 8 \$ 24.5 13 \$ 39.3 18 \$ 55.1 22 \$ 70.4 18 \$ 55.1 23 \$ 70.5 30 \$ 116.3 43 \$ 131.6 45 \$ 131.6 45 \$ 131.7 55 \$ 162.2 56 \$ 177.5 63 \$ 102.8 173 \$ 223.7 78 \$ 238.7 78 \$ 238.7 78 \$ 238.7 78 \$ 238.7 78 \$ 238.7 88 \$ 208.1 77 \$ 223.7 88 \$ 208.1 77 \$ 223.7 88 \$ 208.1 77 \$ 223.7 88 \$ 208.1 78 \$ 223.7 89 \$ 208.1 91 \$ 208.2 89 \$ 209.3 91 \$ 208.2 89 \$ 209.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 208.3 91 \$ 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22432 39591 39640 35692 228055 19860 11218 4753

Table J-1. ECO-2 Calculation of Chiller Energy Cost for New Conditions.

CLANT NO BUILDING DESIGN I WINTER SIMULAT	NO: LOAD:		31 87018 902 0 EQ-25	TONS %DSGN	MASTER COMPRE CONDEN REFRIGE	SSOR: SER: RANT:	NO (LE	.D):		48 CENT WATER R-123	W/ TURBO	COMPRE CONDEN REFRIGE	ISER: ERANT:	NO (LAG	11):		47 CENT WATER R-123 NEW	
EAK DE			548.0 1011576	KW KWHYR	STATUS:	RATION:				SERIES/S			URATION: SETPOIN				SERIES/S	SINGLE
					MAXILEA		or PRO-	RATELO	AD:	85 95	%	LOAD LI		11:			100	*
EMAND			\$83,625 \$24,278	Λ/R Λ/R	LOAD L	AI 1;				•••	~	20/12 22						
ENERGY FOTAL C			\$107,903	ΛΥR	RATED O		<b>f</b> :			474.0 279.6	TONS !	RATED O	CAPACITY POWER:	<b>′</b> :			474.0 279.6	TONS
INIT OU	TPUT COS	T:	\$117	/TON"YR	RATED E		CY:			0.590	KW/TON	RATED	FFICIEN	CY:			0.590	KW/TON
×	PLANT	PLANT	ANNUAL	PLANT	CHIL	%	%	%	POWER	ANNUAL	ANNUAL	CHIL	%	%	%	POWER	ANNUAL	ANNUAL
TANE		LOAD	OCCUR	DEMAND	LOAD	RAT	RAT	RAT		OCCUR	ENERGY	LOAD	RAT	CAP	RAT		ADJUST	ENERGY
SGN		SHED	ACTUAL			CAP	CAP	POW		ADJUST	CONSUMP		CAP	ADJ	POW		AMUSI	CONSUM
OAD						ACT	ADJ						ACI	700				
×	TONS	TONS	HR/YR	ĸw	TONS	*	*	%	ĸw	HR/YR	KWH/YR	TONS	*	*	%	KW	HRYR	KWHYR
0 W	0.0	0.0	4380	0.0	0.0		0	0	0.0	0	0	0.0	0	0	0	0.0	0	
35	27.1	0.0	37	5.6	27.1	8	15	2	5.6	15	84	0.0	0	0	0	0.0	0	
8.5	72.2	0.0	50	5.6	72.2	15	15	2	5.6	50	280	0.0	0	0	0	0.0	0	
13 S	117.3	0.0	65	16.8	117.3	25	25	8	16.8	65	1092	0.0	0	0	0	0.0	0	
18 S	162.4	0.0	83	33.6	162.4	34	34	12	33.6	83	2789	0.0	0	0	0	0.0	ň	
23 \$	207.5	0.0	108	55.9	207.5	44	44	20	55.9	108	5925	0.0	0	ŭ	ŏ	0.0		
28 5	252.6	0.0	143	81.1	252.6	53	53	29	81.1	143	11597	0.0	ŭ	Ň	ă	0.0	ŏ	
33 S	297.7	0.0	184	117.4	297.7	63	63	42	117.4	184 232	21802   35682	0.0	ŏ	ň	ă	0.0	ŏ	
38 S	342.8	0.0	232	153.8	342.8	72	72	55 71	153.8 198.5	252	51412	0.0	ŏ	ň	٥	0.0	ŏ	
43 \$	387.9	0.0	259	198.5	387.9	82	82 21	74	11.2	292	3270	331.8	70	70	61	170.6	292	498
48 S	433.0	0.0	292	181.8	101.2	21 31	31	10	28.0	343	9604	331.8	70	70	61	170.6	343	585
53 S	478.1	0.0	343	198.6	146.3	40	40	17	47.5	381	18098	331.8	70	70	61	170.6	381	649
58 S	523.2	0.0	381	218.1 243.3	236.5	50	50	26	72.7	388	28208	331.8	70	70	61	170.6	388	661
63.5	588.3	0.0	388 374	271.3	230.5	59	59	36	100.7	374	37862	331.8	70	70	61	170.6	374	638
68 S 73 S	613.4 658.5	0.0	357	310.4	328.7	69	69	50	139.8	357	49909	331.8	70	70	61	170.6	357	809
78 S	703.6	0.0	308	352.3	371.8	78	78	65	181.7	308	55984	331.8	70	70	61	170.6	308	525
#3 S	748.7	0.0	247	374.7	345.8	73	73	58	156.6	247	38680	402.9	85	85	78	218.1	247	538
88 S	793.8	0.0	171	416.6	390.9	82	82	71	198.5	171	33944	402.9	85	85	78	218.1	171	372
93 5	838.9	0.0	109	455.7	364.9	77	77	63	176.1	109	19195	474.0	100	100	100	279.6	109	304
98 5	884.0	0.0	59	500.5	410.0	88	86	79	220.9	59	13033	474.0	100	100	100	279.6	59	184
103 S		4.8	25	548.0	450.3	95	95	96	268.4	25	6710	474.0	100	100	100	279.8	25	69
108 S		49.9	7	548.0	450.3	95	95	96	268.4	7	1879	474.0	100	100	100	279.6 279.6	7 2	19
113 S		95.0	2	548.0	450.3	95	95	96	268.4	2	537	474.0 474.0	100	100	100	279.6	0	
118 S	1064,4	140.1	0	548.0	450.3	95	95	96	268.4			474.0	100	.00	100	_,,,,		
										4200	447158						3063	5644

APPENDIX J

Table J-2. ECO-2 Summary of Chiller Energy Cost of New Conditions.

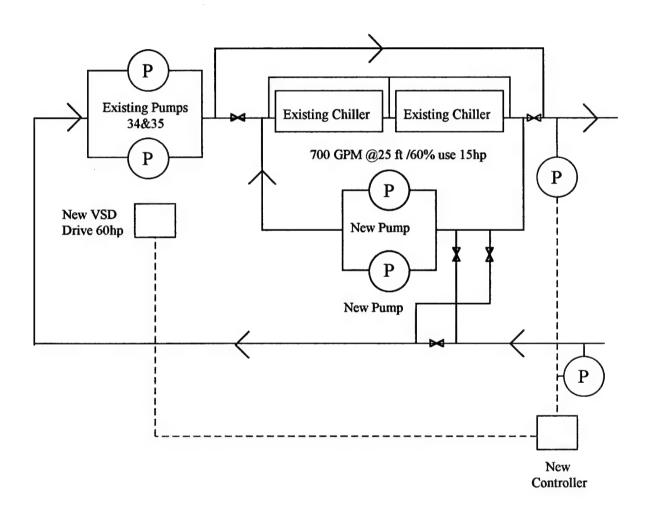
PLANT w/ TURB	DUNIT	\$/TON*YR	'	•	•	138	2 '	134		135	•	1	•	139	118	. '	116	129	132	120	131	•	٠	119	122	137	· '	,	130	117	•	
PLANT w/ TURB	ENERGY	\$/YB	•	٠	•	32086	'	25573	•	40247	•	•	,	31669	52114	'	96704	56284	57582	151135	34191	•		113774	133720	29668	•	•	37853	107903	•	
PLANT w/ TURB	CONSUMP	KWH/YR		•	•	316414		230672	•	426890	•	•	•	285667	501083	•	941073	507623	561689	1644885	280142	•	•	1122680	1282336	275440	•	•	368478	1011576	•	
PLANT w/ TURB	PEAK DEMAND	Κ		•	•	160.5		131.3	•	196.6	•	•	•	162.6	262.7	•	485.7	289.0	289.0	731.7	180.0	•	•	569.0	674.6	151.1	•	•	190.1	548.0	•	
PLANT w/ TURB	MAX OUTPUT	TONS	,	•	•	232.1	٠	191.0	•	298.4	•	•	•	228.0	441.8	•	831.9	437.0	437.0	1255.8	261.3	,	•	955.5	1092.0	216.1	•	1	290.7	924.3	•	
PLANT NEW/	EXIST	%	69	71	47	108	77	81	100	73	93	110	114	112	100	108	90	SAME	SAME	100	100	SAME	100	81	100	100	06	100	82	100	100	93
PLANT NEW	CAP	TONS	138.0	91.0	107.0	238.0	116.0	201.0	170.0	306.0	158.0 +	154.0	166.0	240.0	465.0	238.0	853.2	460.0	460.0	1277.1	275.0	95.5	96.2	980.0	1120.0	227.5	188.1	129.2	306.0	948.0	121.8	10325.6
OPER SCHED		HR/YR	4380	4380	4380	4380	4380	4380	4380	8760	8760	4380	4380	4380	4380	4380	4380	4380	4380	8760	4380	4380	8760	4380	4380	4380	4380	8760	8760	4380	4380	
PLANT HAP	CALC	TONS	138	91	107	238	116	201	176	306	158	154	166	240	486	238	836	458	485	1155	259	110	96	980	1084	232	189	129	306	902	123	10159
PLANT	O Z		121	135	194	410	2805	5764	5792	7050	7051	14020	14023	21002	27004	28000	29005	31008	34008	36000	36006	36009	36014	39015	39043	41003	42000	50001	50004	87018	91001	
PLANT			-	7	ო	വ	9	7	ω	တ	10	<del>1</del> 3	4	15	16	17	18	19	50	21	22	23	24	25	56	27	28	29	30	33	32	

APPENDIX J

Table J-3. ECO-2 Calculation of Simple Payback Periods.

			PAYBK	22	•	•	•	•	•	12.9	•	•	•	•	•	11.9	10.7	•	10.4	15.9	16.8	5.5	10.0	•	•	9.1	7.7	11.4	•	•	5.5	9.6	•	
ADD	SPD CTRL		<u>-</u>	P	•	•	•	TOO SMALL	•	30250	•	TOO SMALL	<b>TOO SMALL</b>	•	•	34490	48247	<b>TOO SMALL</b>	44208	81557	81557	44224	34259	•	•	47879	46660	29979	•	TOO SMALL	34114	48112	•	605536
			6	0	•	•	•	မှ	•	ω	•	ω	•	•	,	ကု	ω	•	4	ω	œ	Ŋ	0	•	•	4	4	ω	•	•	14	4	,	
PLANT w/ TURB	ENERGY	COST	SAVED	L /6	•	•	•	-1682	•	2341	•	3442	•	1	'	-1045	4524	•	4267	5134	4867	8062	3431	•	•	5265	6071	2641	,	•	6157	5003	•	58478
			ò	0	•	•	•	10	٠	2	•	22	•	•	٠	2	19	٠	Ξ	21	18	4	25	٠	٠	=	=	20	•	•	36	12	•	
PLANT w/ TURB	CONSUMP	SAVED	מאוואא	שו /שאע	•	•	•	33529	•	62612	•	118013	•	•	•	74721	119183	•	114860	137597	126495	272989	95246	1	•	145628	165216	69669	•	•	206324	137255	•	1879637
			ò	0	•	•	•	÷	1	4	ı	0		ı	•	<del>.</del> 13	4	٠	8	4	4	-	4	•	•	8	0	4	•	•	4	7	1	
PLANT w/ TURB	PEAK	DEMAND	SAVED	NW/IN	•	•	•	-16.3	•	5.5	•	4.0	•	•	•	-18.6	10.9	•	9.9	12.0	12.0	9.6	7.5	•	•	11.6	13.8	6.3	•	•	7.9	11.2	٠	87.6
PLANT NEW/		CAP	ò	e c	6 i	71	47	108	77	8	100	73	93	110	114	112	100	108	90	SAME	SAME	100	100	SAME	100	81	100	100	06	100	85	100	100	93
PLANT NEW	CAP		ONOT		138.0	91.0	107.0	238.0	116.0	201.0	170.0	306.0	158.0	154.0	166.0	240.0	465.0	238.0	853.2	460.0	460.0	1277.1	275.0	95.5	96.2	980.0	1120.0	227.5	188.1	129.2	306.0	948.0	121.8	10325.6
PLANT EXIST	CAP		O NO.	200	200.0	128.4	228.0	220.0	149.8	249.6	170.0	420.0	170.0	140.4	146.0	215.0	465.0	220.0	948.0	460.0	460.0	1277.0	275.0	95.5	36.2	1215.0	1120.0	227.5	209.0	129.2	375.0	948.0	121.8	11079.4
OPER			200	70001	4500	4380	4380	4380	4380	4380	4380	8760	8760	4380	4380	4380	4380	4380	4380	4380	4380	8760	4380	4380	8760	4380	4380	4380	4380	8760	8760	4380	4380	
	CALC	LOAD	ONOT	250	0 0	9	107	238	116	201	176	306	158	154	166	240	486	238	836	458	485	1155	259	110	96	980	1084	232	189	129	306	902	123	10159
PLANT	2			+0+	77	135	194	410	2805	5764	5792	7050	7051	14020	14023	21002	27004	28000	29005	31008	34008	36000	36006	36009	36014	39015	39043	41003	42000	50001	50004	87018	91001	
PLANT NO				-	- (	N	က	5	9	7	89	ō	10	13	14	15	16	17	18	19	20	21	22	23	24	25	56	27	28	59	30	31	32	

# Appendix K: ECO-3 (Install Variable Speed Drives for Pumps)



Try building 39015 for primary/secondary variable speed pumping.

### Base Case Energy Consumption.

Original design flow

1696 GPM @ 16 degrees delta T

Measured flow

1312 GPM @ 191 ft efficiency=73%

BHP=43.2*2

New design flow

980T @ 16∠ δT=1470 GPM

(1470/1312)2=delta P/191 therefore delta P=240 ft

Existing chilled water pressure drop=7 + 9=16 ft

Pumps 34 and 35

Aurora 60 HP

1770 RPM

use 700 GPM each @ 217 ft (max impeller)

 $(1400/1312)^3$ =BHP/43.2 bhp=52.5 * 2=105

 $kW=105 \ BHP *0.7457/0.954$  ( high efficiency motor)=82.1 @ \$152.60= \$12,524/yr

kWh=82.1 kW * 4380=359598 @ \$0.0240=\$8,630/yr

Total cost=\$21,154/yr

#### Energy Consumption With Variable Speed Drive.

Same as if Variable Speed Drive is limited to 95% load=\$12,524/yr

Use 57% Average % full load per Appendix F

Neglect base load of primary pumps (benefit to ECO)

Neglect inefficiency loss of variable speed drive (benefit to ECO)

BHP= $(0.57)^3 * 105=19.4$ 

 $kW_{avg}$ =19.4 BHP * 0.7457/0.954=15.2

kWh=15.2 kW * 4380 @ \$0.024=\$1,598/yr

Total cost=\$14,122/yr

Target \$7,032/yr saved *10 yrs = \$70,000 capital cost

#### Variable Speed Drive Construction Cost.

60 hp VSD

Motor connection

wire 4-#2 @ 100 ft

conduit

1.1/4" @25 ft

controls

2 pressure sensors

1 output

test

Primary pump

700 gal

15 hp (2 of these)

(similar to building 50004 and 12015)

8" pipe @ 100 ft

8" elbow (24)

8" insulation @ 100 ft

8" valve (4)

#### Flow/Fill/Test

 $1400~{\rm gpm}$ out/ $20~{\rm building}$  –  $70~{\rm gpm/building}$ 

Use 5 - 2 in 485 * 1.5

15 - 11/2 in 370 * 1.5

20 Sensor + Panel @ 750

70% 20 Electrical * \$6 * \$45/hr

70% Extra Pipe Labor * \$8 * \$45/hr

Material	Totals
\$10,162*1.1	\$11,178
	\$14
	\$107
	\$72
	\$2,500
\$6,800*2	\$13,600
	\$3,080
	\$2,033
	\$310
	<u>\$946</u>
	\$33,840

Labor	Totals
100 hp Starter	\$359
	\$57
	\$54
	\$91
	\$500
\$5,200*2	\$10,400
	\$2,513
	\$4,331
	\$485
	\$600
	\$3,000
	\$194
	<u>\$338</u>
	\$22,922

```
$22,922
```

\$33,840

\$56,762

+15%

\$65,276

in Plant

\$3,638

\$8,325

\$15,000

\$3,780

\$5,040

\$35,783

+15%

\$41,150

41,150/20 = 2,000/Building

106,426/7000 = 15 yr and climbing

# Appendix L: ECO-4 (Replace Fan and Pump Motors)

APPENDIX L

Table L-1. ECO-4 Calculation of Simple Payback Periods for Chilled Water Pumps

NO   NO   NO   NO   NO   NO   NO   NO	PLANT	PLANT		MST		}	PUMP	NEW	DELTA	STD	MOTOR	MOTOM		_	MOTOR	1	POW	MOTOR	MOTOR
142   1   4   4   4   6   5   6   6   6   1   5   5   6   6   1   6   6   6   1   6   6   6	2	BLDG	58	N O	SCHED	POW	STATUS	100% EFF	EFF	EPIN THE	UTIL REBATE	LIST	CONNECT LAB COST		TOTAL	COST	COST	COST	PAYBK W/ REB
121   1 4380					HRYR	모		%	%	%	69	ы	€9	€9	49	\$ A A	\$. A.∨	8∨R	YRS
135   2   4380   5   OK   910   0.4NT   815   48   970   610   115   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   628   6	-	121	-	-	4380	10	ò	91.7	CANT	85.5	79	633	í	181	1010	1	CANT	CANT	CAN'T
135 3 4 4380	2	135	2	2	4380	5	ŏ	90.0	5.5	82.5	48	370	09	115	628		CANT	CANT	CAN
144   4   41380   75   014   94.0 CANT 895   895   125   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   815   8		135	3	3	4380	5	ŏ	90.0	CANT	82.5	48	370	60	115	628		CANT	CANT	CAN'T
410   6   5   4380   7.5   OK   92.0   8.0   8.4   7.3   5.8   6.0   145   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8.5   8	က	194		4	4380	25	Š	94.0	CAN'T	89.5	150	1226	81	312	1875		3373	CANT	CAN'T
410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         7         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410         6410	5	410		2	4380	7.5	ŏ	92.0	8.0	84.0	73	538	9	145	859		940	06	8.7
2905         B         7 4380         15         OK         93.0         CANT         88.0         98.6         88.4         81         218         1345           5792         1         9         4380         15         OK         93.0         6.37         88.0         98.6         88.4         81         124         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194         194<		410		9	4380	7.5	Š	92.0	8.0	84.0	73	538	09	145	859		888	86	6
5764         9         8 4380         15         OK         33.0         3.5         88.0         98         664         81         216         1345           7050         12         10         8760         25         OK         33.0         6.5         89.5         128         1212         81         312         165           7051         14         12         8760         25         OK         33.0         6.5         89.5         128         1212         81         312         185           7051         14         12         8760         25         OK         33.0         6.5         89.5         128         1212         81         312         185           7051         14         310         15         OK         31.7         4.86         3.0         6.5         89.0         89.8         89.8         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89         89	9	2805		7	4380	15	o X	93.0	CAN'T	88.0	86	864	81	218	1345		1695	CANT	CANT
5792         11         9         4380         20         OK         33.6         CANT         88.5         182         105         81         252         153           7050         12         10         8760         25         OK         30.0         6.5         89.5         128         121         81         212         81         312         185           7051         14         41         8760         15         OK         93.0         6.5         89.5         188         121         81         312         185           7051         14         4380         10         OK         91.7         6.1         85.5         79         633         60         181         1010           21002         2         16         4380         10         OK         91.7         6.1         85.5         79         633         60         181         1010           21002         2         10         OK         91.7         6.1         85.5         79         633         60         181         1010           21002         2         10         OK         92.4         ANT         88.6         81         81 <td>7</td> <td>5764</td> <td></td> <td>89</td> <td>4380</td> <td>15</td> <td>ŏ</td> <td>93.0</td> <td>3.5</td> <td>88.0</td> <td>86</td> <td>864</td> <td>81</td> <td>218</td> <td>1345</td> <td></td> <td>CANT</td> <td>LANI</td> <td>PNAC</td>	7	5764		89	4380	15	ŏ	93.0	3.5	88.0	86	864	81	218	1345		CANT	LANI	PNAC
7050         12         11         8760         25         OK         93.0         6.5         89.5         128         1212         81         312         185           7050         13         11         8760         25         OK         93.0         6.5         89.5         128         172         81         312         185           7051         14         12         8760         25         OK         93.0         6.5         89.5         128         172         81         312         185           14022         20         14         4380         10         OK         91.7         4.7         85.5         79         633         60         181         101           14022         21         16         4380         10         OK         92.4         CANT         86.5         91         89.5         190         89.5         60         181         101           27004         20         18         92         18.6         89.5         18.6         89.5         18.6         89.5         18.6         18.6         18.6         18.6         18.6         18.6         18.6         18.6         18.6         18.6	80	5792		0	4380	20	ŏ	93.6	CANT	88.5	132	1005	8	282	1593		2361	LANT	FNAC
7050         13         14         8760         25         OK         93.0         6.5         B9.5         128         1212         B1         312         165           7051         15         13         16         15         AOK         91.0         7.0         B9.0         99         B64         B1         218         1345           7051         15         13         0.0         15         BACKIN         B1.7         6.1         B5.5         79         633         60         181         1010           21002         22         16         4380         10         OK         93.6         CANT         B8.0         91         B87         B1         201         101           27004         23         17         4380         15         OK         92.4         CANT         B8.0         91         B87         B1         101           28000         25         10         M.         92.4         CANT         B8.0         91         B8         101         101           28000         25         10         M.         92.4         CANT         B8.0         10         12         11         17	Ø	7050		10	8760	25	ð	93.0	6.5	89.5	128	1212	9 18	312	1858		5644	424	4
7051         14         12         8760         15         OK         93.0         7.0         88.0         98         864         81         218         144           14020         20         14         98         16         16         16         16         16         16         16         16         16         17         1         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <td></td> <td>7050</td> <td></td> <td>Ξ</td> <td>8760</td> <td>25</td> <td>ŏ</td> <td>93.0</td> <td>6.5</td> <td>89.5</td> <td>128</td> <td>1212</td> <td>8</td> <td>312</td> <td>1858</td> <td></td> <td>5644</td> <td>424</td> <td>. 7</td>		7050		Ξ	8760	25	ŏ	93.0	6.5	89.5	128	1212	8	312	1858		5644	424	. 7
7051         15         140 Co.         15         BACKUP	10	7051		12	8760	15	ŏ	93.0	7.0	88.0	98	864	81	218	1345		2589	211	5.9
14020         20         14 4380         10         OK         91.7         6.1         B5.5         79         633         60         181         1010           21002         2.1         4.380         10         OK         91.7         4.7         86.5         79         66.3         181         1010           21002         2.3         15 4380         10         OK         92.4         CANT         88.0         91         887         81         218         173           27004         2.3         17 4380         15         OK         92.4         CANT         88.0         91         887         81         218         190         197           28000         2.5         2.0         4.8         92.0         5.5         84.0         7.3         538         60         145         859           28000         2.5         2.0         4.0         4.8         89.5         150         126         145         869           28000         2.5         2.0         4.9         4.8         89.5         150         126         87.1         86.0         145         86.9         140         148         89.5         150		7051		13	0	15	BACKUP	'		•	1	•	•	•	•			•	
14023         21         15         4380         10         OK         91,7         4,7         86.5         79         633         60         181         1010           27004         2         16         4380         15         OK         92,6         CANT         88.5         192         189         181         292         189           27004         3         18         4380         15         OK         92,6         CANT         88.0         91         887         81         218         1373           27004         3         18         4380         7.5         OK         92,0         5.5         BA         73         538         60         145         865           28000         2         2         14         380         60         OK         95,4         CANT         91,5         320         2532         133         60         145         865           28000         2         2         4         4         91,5         320         2532         133         514         3691           31008         2         2         4         4         91,5         4         4         91,5	13	14020		14	4380	10	ŏ	91.7	6.1	85.5	79	633	9	181	1010	1706	1593	113	8.9
21002         22         16         4380         20         OK         93.6         CANT         88.5         132         1005         81         292         1592           27004         23         17         4380         15         OK         92.4         CANT         88.0         91         887         81         218         1373           27004         24         19         4380         15         OK         92.0         6.5         84.0         73         538         60         145         853           28000         25         21         4380         60         OK         95.4         4.4         91.5         528         60         145         863           28000         25         21         4380         60         OK         95.4         4.4         91.5         528         133         514         3691           28000         27         22         4380         25         OK         94.0         4.8         89.5         150         1226         81         3691         145         8691           34008         28         24         24         4         91.5         80.5         120	14	14023		15	4380	10	ŏ	91.7	4.7	85.5	79	633	09	181	1010	1767	1677	06	10.3
27004         23         17         4380         15         OK         92.4         CANT         88.0         91         887         81         218         1373           27004         4         18         4380         15         OK         92.0         CANT         88.0         91         887         81         218         1373           28000         25         20         4380         7.5         OK         92.0         6.5         84.0         73         538         60         145         869           28000         25         20         4380         60         OK         95.4         AMNT         91.5         320         2532         133         514         3691           28000         26         21         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         28         24         4.8         89.5         150         1226         81         312         1875           34008         29         24         4.8         89.5         150         1226         81         312         1875	15	21002		16	4380	50	ŏ	93.6	CANT	88.5	132	1005	81	292	1593	CANT	2792	CANT	CANT
27004         18         4380         15         OK         92.4         CANT         88.0         91         887         81         21         21           28000         24         19         4380         7.5         OK         92.0         3.5         84.0         73         538         60         145         869           28000         26         21         4380         7.5         OK         92.0         3.5         84.0         73         538         60         145         869           29005         27         22         4380         60         OK         94.0         4.8         91.5         120         2532         133         514         3691           31008         28         24         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           34008         29         25         OK         94.0         4.5         89.5         150         1226         81         31         1875           34008         29         25         OK         94.0         4.5         89.5         150         1226         81	16	27004		17	4380	15	o X	92.4	CANT	88.0	91	887	81	218	1373	CANT	CANT	LAN	CANT
28000         24         19         4380         7.5         OK         92.0         6.5         84.0         73         538         60         145         869           28000         25         20         4380         7.5         OK         92.0         6.5         84.0         73         538         60         145         869           29005         27         22         4380         60         OK         95.4         4.4         91.5         320         2532         133         514         3691           31008         28         23         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         29         25         AV         94.0         4.8         89.5         150         1226         81         312         1875           34008         29         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         20         OK         94.0         4.5         89.5         150         1226         81         312         1875 <td></td> <td>27004</td> <td></td> <td>18</td> <td>4380</td> <td>15</td> <td>ŏ</td> <td>92.4</td> <td>CANT</td> <td>88.0</td> <td>6</td> <td>887</td> <td>81</td> <td>218</td> <td>1373</td> <td>CANT</td> <td>CANT</td> <td>LANT</td> <td>CANT</td>		27004		18	4380	15	ŏ	92.4	CANT	88.0	6	887	81	218	1373	CANT	CANT	LANT	CANT
28000         25         20         4380         7.5         OK         92.0         6.5         84.0         73         538         60         145         869           29005         26         21         4380         7.5         OK         95.4         CANT         91.5         320         2532         133         514         3691           31008         28         23         4380         60         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         24         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         29         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           34008         20         OK         95.0         CANT         91.5         250         206         104         486         3080           36000         30         25         OK         95.0         CANT         91.5         250         2066         104         486         3080	17	28000		19	4380	7.5	O	92.0	3.5	84.0	73	538	9	145	859	1281	1232	49	16.0
29005         26         21         4380         60         OK         95.4         CANT         91.5         320         2532         133         514         3691           29005         27         22         4380         60         OK         95.4         4.4         91.5         320         2532         133         514         3691           31008         28         24         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           34008         29         25         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         29         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         25         OK         94.0         4.5         89.5         150         104         486         3080           36000         32         29         8760         50         OK         95.4         34.9         91.5         206         104         48.6		28000		20	4380	7.5	ŏ	92.0	6.5	84.0	73	538	09	145	859	1214	1128	86	
29005         27         22         4380         60         OK         95.4         4.4         91.5         320         2532         133         514         3691           31008         28         23         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         29         25         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         26         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         26         OK         94.0         4.5         89.5         150         164         486         3080           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         32         28         8760         OK         95.0         CANT         91.5         250         2066         104 <t< td=""><td>18</td><td>29005</td><td></td><td>21</td><td>4380</td><td>9</td><td>ŏ</td><td>95.4</td><td>CAN'T</td><td>91.5</td><td>320</td><td>2532</td><td>133</td><td>514</td><td>3691</td><td>CANT</td><td>6688</td><td>CANT</td><td>CANT</td></t<>	18	29005		21	4380	9	ŏ	95.4	CAN'T	91.5	320	2532	133	514	3691	CANT	6688	CANT	CANT
31008         28         23         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           31008         24         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           34008         26         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           34008         26         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         32         8760         50         OK         95.4         ANT         91.5         250 <t< td=""><td></td><td>29005</td><td></td><td>22</td><td>4380</td><td>9</td><td>ŏ</td><td>95.4</td><td>4.4</td><td>91.5</td><td>320</td><td>2532</td><td>133</td><td>514</td><td>3691</td><td>7011</td><td>6688</td><td>323</td><td>10.4</td></t<>		29005		22	4380	9	ŏ	95.4	4.4	91.5	320	2532	133	514	3691	7011	6688	323	10.4
3100B         24         4380         25         OK         94.0         4.8         89.5         150         1226         81         312         1875           3400B         25         2480         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           3400B         25         A380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         50         OK         95.4         CANT         91.5         250         253         133         514         486         3080           36004         32         88         86         96.5         85.4         49.15         369	19	31008		23	4380	25	ŏ	94.0	4.8	89.5	150	1226	81	312	1875	CANT	CAN'T	CANT	CANT
34008         29         25         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           34008         26         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         60         OK         95.0         CANT         91.5         250         2666         104         486         3080           36000         30         8760         50         OK         95.0         CANT         91.5         320         2532         133         514         3691           36000         33         81         8760         50         OK         95.4         CANT         91.5         320         2532         133         514         4399           36014         36         37         81         81.5         40         30.8         60 <t< td=""><td></td><td>31008</td><td></td><td>24</td><td>4380</td><td>25</td><td>š</td><td>94.0</td><td>4.8</td><td>89.5</td><td>150</td><td>1226</td><td>81</td><td>312</td><td>1875</td><td>CANT</td><td>CANT</td><td>CANT</td><td>CANT</td></t<>		31008		24	4380	25	š	94.0	4.8	89.5	150	1226	81	312	1875	CANT	CANT	CANT	CANT
34008         26         4380         25         OK         94.0         4.5         89.5         150         1226         81         312         1875           36000         30         27         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         50         OK         95.0         CANT         91.5         250         2066         104         486         3080           36000         31         28         8760         50         OK         95.4         CANT         91.5         260         266         104         486         3080           36000         30         8760         50         OK         95.4         CANT         91.5         32         898         60         145         899           36004         35         31         8760         50         OK         91.9         85.5         86         981         60         145         889           36014         36         36         47.8         47.4         74.7         91.5         320         2532	50	34008		25	4380	25	Š	94.0	4.5	89.5	150	1226	81	312	1875	CANT	CANT	CANT	CANT
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36000 32 29 8 760 60 OK 95.4 3.0 91.5 320 2532 133 514 3691 36000 32 29 8 760 60 OK 95.4 9.4 9.8 15 5000 3084 156 544 4399 36000 33 31 8 760 10 0 K 92.0 CANT 84.0 73 538 60 145 859 859 801 60 145 859 8500 34 32 4380 7.5 0K 92.0 CANT 91.5 320 2532 133 514 3691 3691 39015 38 3760 20 0K 95.4 CANT 91.5 320 2532 133 514 3691 39015 38 38 4380 75 0K 94.5 3.8 91.5 344 3333 156 544 4692 39043 40 37 4380 75 0K 94.5 3.8 91.5 344 3333 156 544 4692 42000 42 39 4380 15 0K 93.0 CANT 88.0 99 864 81 218 1345 50004 44 41 8760 7.5 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75 DEMO 75		36000		28	8760	20	ŏ		CANT	91.5	250	2066	104	486	3080	CANT	CANT	CAN'T	CANT
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36006 34 32 31 8 F60 10 OK 92.4 9.9 85.5 85 981 60 181 1419 36019 34 32 4380 7.5 OK 92.0 CANT 84.0 73 538 60 145 859 36014 36 33 8 766 20 OK 95.0 CANT 91.5 320 2532 133 514 3691 39015 37 34 4380 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 39043 39 36 4380 75 OK 94.5 3.5 91.5 344 3333 156 544 4692 41003 41 38 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 42000 42 39 4380 15 OK 93.0 CANT 88.0 99 864 81 218 1345 50004 45 42 8760 7.5 DEMO	Ġ	36000		30	8760	75	š		CANT	91.5	400	3084	156	544	4399	CANT	CANT	CANT	CANT
36019 34 32 4380 7.5 OK 92.0 CANT 84.0 73 538 60 145 859 360 361 362 361 37 34 38 456 0 0K 91.9 3.4 88.5 102 809 81 292 1362 39015 37 34 380 60 0K 95.4 CANT 91.5 320 2532 133 514 3691 39015 38 35 4380 60 0K 95.4 CANT 91.5 320 2532 133 514 3691 39015 39 36 4380 75 0K 94.5 3.5 91.5 344 3333 156 544 4692 39043 40 37 4380 15 0K 93.0 CANT 88.0 98 864 81 218 1345 62001 43 40 8760 15 0K 93.0 CANT 88.0 99 864 81 218 1345 65004 44 11 8760 7.5 REPL	22	36006			8/60	0	S S		6.0	85.5	82	981	09	181	1419	2165	1933	232	5.8
39014 35 33 8760 20 OK 91.9 3.4 88.5 102 809 81 292 1362 39015 37 34 480 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 891 39015 38 35 4380 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 39015 38 35 4380 75 OK 94.5 3.5 91.5 344 3333 156 544 4692 39043 40 37 4380 75 OK 94.5 3.8 91.5 344 3333 156 544 4692 42000 42 39 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 65001 43 40 8760 15 OK 93.0 CANT 88.0 99 864 81 218 1345 65004 44 41 8760 7.5 BEPL	53	36009		35	4380	7.5	š		CAN'T	84.0	73	538	9	145	828	CANT	1400	CANT	CANT
39015 37 34 4380 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 3691 39015 38 35 4380 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 3691 39043 39 36 4380 75 OK 94.5 3.8 91.5 344 3333 156 544 4692 39043 40 37 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 65004 44 41 8760 7.5 REPL	4 7	35014		500	8/60	0.7	Y :		4.7	88.5	102	808	8	292	1362	4341	4181	160	7.9
39015 38 35 4380 60 OK 95.4 CANT 91.5 320 2532 133 514 3691 3691 39043 39 36 4380 75 OK 94.5 3.5 91.5 344 3333 156 544 4692 39043 40 37 4380 75 OK 94.5 3.5 91.5 344 3333 156 544 4692 41003 41 38 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 42000 42 39 4380 15 OK 92.4 4.4 88.0 91 887 81 218 1345 50004 44 18 760 7.5 DEMO	62	38015		4 1	4380	09	S (		CAN	91.5	320	2532	133	514	3691	CANT	8703	CANT	CANT
39043 39 36 4380 75 OK 94.5 3.5 91.5 344 3333 156 544 4692 39043 40 37 4380 75 OK 94.5 3.8 91.5 344 3333 156 544 4692 39043 41 37 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 65001 43 40 8760 15 OK 93.0 CANT 88.0 91 887 81 218 1345 55004 44 41 8760 7.5 REPL	•	39010		3	4380	9	Š		CAN	91.5	320	2532	133	514	3691	CANT	8703	CANT	CANT
39043 40 37 4380 75 OK 94.5 3.8 91.5 344 3333 156 544 4692 41003 41 38 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 65001 42 99 4380 15 OK 93.0 CANT 88.0 99 864 81 218 1345 65004 44 41 8760 7.5 REPL	56	39043		36	4380	75	Š:		3.5	91.5	344	3333	156	544	4692	11341	10921	420	10.4
41003 41 38 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 64000 42 39 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 64000 42 39 4380 15 OK 93.0 CANT 88.0 91 867 81 218 1345 65004 44 41 8760 7.5 REPL		39043		37	4380	75	Š Š		3.8	91.5	344	3333	156	544	4692	11378	10921	457	9,5
42000 42 39 4380 15 OK 93.0 CANT 88.0 98 864 81 218 1345 65001 43 40 8760 15 OK 92.4 4.4 88.0 91 887 81 218 1373 55004 45 41 8760 7.5 DEMO	27	41003		38	4380	15	š		CANT	88.0	86	864	81	218	1345	CANT	2397	CANT	CANT
50001 43 40 8760 15 OK 92.4 4.4 88.0 91 887 81 218 1373 50004 44 41 8760 7.5 REPL	28	42000		33	4380	15	ŏ		CANT	88.0	98	864	81	218	1345	CANT	2686	CANT	CANT
50004 44 41 8760 7.5 REPL	53	50001		40	8760	5	o Y	92.4	4.4	88.0	91	887	81	218	1373	2244	2138	106	12.1
50004 45 42 8760 7.5 DEMO	30	50004		4	8760	7.5	REPL	*		•	1	•	•	•	•			•	
50004 46 43 8760 7.5 DEMO		50004		42	8760	7.5	DEMO	1		1	•	,	1	•	•			•	
87018 47 44 4380 60 OK 95.4 4,4 91.5 320 2532 133 514 3691 87018 48 45 4380 60 OK 95.4 4,4 91.5 320 2532 133 514 3691 91001 49 46 4380 7.5 OK 92.0 CANT 84.0 73 538 60 145 859		50004		43	8760	7.5	DEMO	•		•	•	'	•	•	•		•	•	
87018 48 45 4380 60 OK 95.4 4.4 91.5 320 2532 133 514 3691 91001 49 46 4380 7.5 OK 92.0 CANT 84.0 73 538 60 145 859	34	87018		44	4380	9	ŏ	95.4		91.5	320	2532	133	514	3691	7962	7595	367	9.5
91001 49 46 4380 7.5 OK 92.0 CAN'T 84.0 73 538 60 145 859		87018		45	4380	09	Š			91.5	320	2532	133	514	3691	7962	7595	367	9.5
	32	91001	- 1	46	4380	7.5	Š		. 1	84.0	73	538	09	145	859	CANT	CAN'T	CANT	CANT

**APPENDIX L** 

Table L-2. ECO-4 Calculation of Simple Payback Periods for Condenser Water Pumps

O _N	BLDG	58	N S	SCHED	Pow	STATUS	NEW 100% EFF	UEL I A EFF	MAN	MOTOR OTTE	LIST C	DISCONNY HEMOVE CONNECT INSTALL LAB COST LAB COST	REMOVE/ INSTALL LAB COST	MOTOH TOTAL COST	COST	COST	COST SAVING	PAYBK W/ REB
				HRVYR	롸		%	%	%	\$	€	\$	\$	\$	\$WR	\$/YR	\$WR	YRS
-	121	- 1	47	4380	20	OK	91.9	CAN'T	88.5	102	808	81	292	1362	CANT	3346	CANT	CANT
N.	135	2	48	4380	c.	T T T	•	,	1	•	•	•	•	1	•	•	,	,
	135	က	40	4380	က	DEMO	•		•	•	1	•	t	•				
6	194	4	20	4380	15	Š	93.0	3.5	88.0	98	864	81	218	1345	2706	2604	102	12.2
S	410	9	51	4380	9	ŏ	91.7	5.2	85.5	79	633	9	181	1010	1400	1320	80	11.6
	410	7	52	4380	10	ŏ	91.7	5.2	85.5	79	633	9	181	1010	1377	1299	78	11.9
9	2805	8	53	4380	2	ŏ	91.7	4.2	85.5	79	633	9	181	1010	2043	1949	94	9.9
7	5764	o	54	4380	10	OK	91.7	CANT	85.5	79	633	09	181	1010	CANT	1802	CANT	CANT
. 20	5792	Ξ	55	4380	20	Ö	93.6	CANT	88.5	132	1005	81	292	1593	CANT	2567	CANT	CANT
6	7050	12	99	8760	20	ŏ	91.9	3.3	88.5	102	808	81	292	1362	4917	4740	177	7.1
	7050	13	57	8760	20	ŏ	91.9	4.4	88.5	102	808	81	292	1362	4948	4711	237	5.3
0	7051	14	58	8760	7.5	Ö	92.0	6.0	84.0	73	538	9	145	859	1793	1676	117	6.7
	7051	15	59	0	7.5	BACKUP	•		•	٠	•		•	•		•	,	
3	14020		9	4380	5	š	91.7	4.2	85.5	79	633	09	181	1010		1802	87	10.7
4	14023		61	4380	2	ð	91.7	4.7	85.5	79	633	9	181	1010		1530	83	11.2
2	21002		62	4380	10	ŏ	91.7	CANT	85.5	79	633	09	181	1010	_	2012	CANT	CANT
9	27004		63	4380	30	ð	94.1	CANT	90.2	163	1425	81	363	2165	_	4391	CANT	CANT
7	28000		64	4380	0	ð	91.7	7.7	85.5	79	633	9	181	1010		1216	Ξ	8.4
	28000		65	4380	10	ð	91.7	7.7	85.5	79	633	09	181	1010		1216	Ξ	8.4
18	29005		99	4380	30	ŏ	94.1	4.6	90.2	163	1425	81	363	2165		5167	566	7.5
	29005		29	4380	30	ŏ	94.1	3.1	90.2	163	1425	81	363	2165		5167	176	11.4
6	31008		68	4380	20	Š	93.6	5.6	88.5	132	1005	81	292	1593	_	CAN'T	CANT	CANT
20	34008		69	4380	30	Š	94.1	CANT	90.2	163	1425	81	363	2165	-	CAN'T	CANT	CANT
_	36000	30	70	8760	30	š	94.1	2.1	90.2	163	1425	81	363	2165	-	CAN'T	CANT	CANT
	36000		71	8760	30	š	94.1	2.1	90.2	163	1425	81	363	2165	_	CANT	CANT	CANT
	36000		72	8760	30	š	94.1	2.1	90.2	163	1425	81	363	2165	_	CANT	CANT	CANT
	36000		73	8760	40	š	95.0	4.0	90.2	247	1772	103	435	2677	_	CANT	CANT	CANT
22	36006	33	74	4380	50	ð	93.6	4.1	88.5	132	1005	81	292	1593		2402	110	13.3
4	36014		9/	8760	2	š	91.0	7.0	82.5	52	370	9	115	628	_	CANT	CANH	CANT
2	39015		11	4380	40	ŏ	95.0	CANT	90.2	247	1772	103	435	2677	_	5705	CAN	CANH
	39015		78	4380	40	ŏ	95.0	4.0	90.2	247	1772	103	435	2677		5705	251	9.7
56	39043		79	4380	20	ŏ	95.0	CANT	91.5	250	2066	104	486	3080	_	8254	CANT	CANT
	39043	40	80	4380	20	ŏ	95.0	CAN'T	91.5	250	2066	104	486	3080	_	8254	CANT	CANT
7	41003	4	81	4380	10	š	91.7	CANT	85.5	79	633	9	181	1010	_	2012	CANT	CANT
89	42000	42	82	4380	15	ð	93.0	8.0	88.0	86	864	81	218	1345	2623	2397	526	5.5
30	50004		83	8760	10	REPL	•		'	•	•	•	•	•				
	50004		84	8760	10	DEMO	١	,	•	•	•	•	•	•		•		
	50004		85	8760	10	DEMO	•	,	'	1	•	•	1	•			,	1
31	87018		86	4380	30	Š	94.1	4.6	90.2	163	1425	81	363	2165	5196	4942	254	7.9
	R7018	48	87	4380	30	Š	94.1	4.6	90.5	163	1425	81	363	2165		4942	254	7.9

### Appendix M: Summary of Chiller Conversion and Retrofit Options

APPENDIX M

Table M-1. Summary of Chiller Conversion and Retrofit Options (by Refrigerant).

The content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the content of the	PLANT MS	_	L	L L										1			
CRAWLERM   LIBS			TYPE	CHRG		EXIS			문 옷	FRIGERANT	DRIVELINE	REPLACE	test	Purge		cost	
1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980   1980		2				SPEC		Taga	ប	NVERSION	RETROFIT	CHILLER	cost	1800			
CENT_HERM   1   DBS						L A	Š	3		PRELIM	PRELIM	PRELIM	v	4	49	%	
FERNING   1				LBS		TONS	TONS		1	ASSESS	ASSESS AVAILABLE	POSSIBI F		6400	85000	79	RETROFIT
15 CENT, PERM   11 600 WAT   1700 1600   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700   1700	121	1 CENT, HERM	=	400	WAT		138.0			NO TIMEST	CONVERT	POSSIBLE	1000	6400	25000	,	CONV -10% CAP & EFF
14 CERT, CPEN 25 CERT, HERM, STG 11 880 WAT 1550 4265 1960 7100 510 510 510 510 510 510 510 510 510	7051	15 CENT, OPEN	=	009	WA		HEIAIN			FASIBLE	CONVERT	POSSIBLE	1000	6400	25000	22	CONV -10% CAP & EFF
2 CENT, HERM, 2876 11 880 WAT 436, 426.5 196017 ES EASIBLE CONVERT POSSIBLE 1000 6400 150000 151 FOR CENT, HERM, 2876 11 1800 WAT 436, 426.5 196017 ES EASIBLE CONVERT POSSIBLE 1000 6400 29000 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 426.5 196017 ES EASIBLE CONVERT POSSIBLE 1000 6400 29000 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 4200 29030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 640.0 20030 15 GO CENT, HERM, 2876 11 1250 WAT 650.0 560.0 22497 15 GO WAT 1250 16 GO CENT, HERM, 2876 11 1250 WAT 1250 16 GO CENT, HERM, 2876 11 1250 WAT 1250 16 GO CENT, HERM, 2876 11 1250 WAT 1250 16 GO CENT, HERM, 2876 11 1250 WAT 1250 16 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WAT 1250 11 1250 WAT 1250 11 1250 WAT 1250 10 GO CENT, HERM, 2876 11 1250 WA	7051	CENT, OPEN	Ξ	009	WAT	170.0	158.0			NO	AVAII ARI F	POSSIBLE	1000	6400	100000	51	RETROFIT
25 CENT, DPEN 11190 WAT 512.0 426.5 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES 19901 TES	29005	CENT, HERM, 2	=	880	WAT	436.0	426.6	•	2 1 2	2 2	AVAIL ABI F	POSSIBLE	1000	6400	100000	51	RETROFIT
CENT, PERM   11 1150 WAT 400.0 435.7 194336 YES   FABSILE   CONNERT   COSSIBLE   1000 6400 28000 15 0 0 0 0 WAT 200.0 WAT 335.9 YES   FABSILE   CONNERT   COSSIBLE   1000 6400 28000 15 0 0 0 0 WAT 200.0 WAT 34.0 29308 YES   FABSILE   CONNERT   COSSIBLE   1000 6400 28000 15 0 0 0 0 WAT 200.0 WAT 34.0 209308 YES   NO AVAILABLE   COSSIBLE   1000 6400 120000 57 0 0 0 0 0 0 WAT 200.0 WAT 200.0 29308 YES   NO AVAILABLE   COSSIBLE   1000 6400 120000 57 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	20005	CENT. HERM. 2	Ξ	880	WAT	512.0	426.6			200	AVAILABLE	110000	1000	6400	29000	5	CONV -10% CAP & EFF
20 CENT, PERM 11 1150 WAT 400.0 425.7 195775 VS RANGE CONNERT POSSIBLE 1000 6400 25000 115 03 0 CENT, PERM 25TG 11 1350 WAT 600.0 425.7 195775 VS RANGE REASIBLE CONNERT POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 1350 WAT 660.0 6500 224947 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 1350 WAT 660.0 6500 224947 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 1000 WAT 209.0 188.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 1000 WAT 125.0 DEWO 188.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 198.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 198.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 198.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 198.1 122751 VES NO AMAILABLE POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 198.2 VES NO CONNERT POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 199.2 VES NO CONNERT POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 199.2 VES NO CONNERT POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 25TG 11 880 WAT 125.0 DEWO 199.2 VES NO CONNERT POSSIBLE 1000 6400 120000 57 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES FEASIBLE 1000 6400 120000 57 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES FEASIBLE 1000 6400 120000 57 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES PEASIBLE 1000 6400 120000 67 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES PEASIBLE 1000 6400 120000 67 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES PEASIBLE 1000 6400 95000 67 10 0 CENT, PERM 12 900 WAT 100 119.0 95705 VES PEASIBLE 1000 6400 95000 67 10 0 CENT, PERM 12 900 WAT 100 1910 95000 PERM 12 900 WAT 100 1910 95900 PERM 12 900 WAT 100 19	36000		Ξ	1400	WAT	400.0	425.7		YES	FEASIBLE	מומא ויאי	POSSIBLE POSSIBLE	1000	6400	110000	26	RETROFIT
CENT, DEFN   11-160 WAT 2760 2750 1   150 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2760 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 WAT 2750 2750   17-160 W	0000	Moun Hauc co	=	1150	WAT	477.0	425.7	195775	YES	2	AVAILABLE	מוספטר ב	000	0400	00000	4	CONV -10% CAP & EFF
SCENT, DPEN   19 00 WAT 554 0 4900 0 203000 VES FRABILE   CONVERT   COSSIBLE   1000   6400 1 20000 ST	36000	SO CENT DEEN	=	1400	WAT	400.0	425.7			FEASIBLE	CONVERT	POSSIBLE	000	6400	25000	2 5	CONV -10% CAP & EFF
39 CENT, HERM, 25TG 11 7250 WMT 56470, 209309 YES NO AVAILABLE POSSIBLE 1000 6400 120000 57 OCENT, HERM, 25TG 11 7250 WMT 6610, 26947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 57 OCENT, HERM, 25TG 11 1250 WMT 6610, 26407 YES NO AVAILABLE POSSIBLE 1000 6400 120000 57 OCENT, HERM, 25TG 11 100 WMT 1260 0610 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 57 OCENT, HERM, 25TG 11 100 WMT 1260 0610 16917 YES NO AVAILABLE POSSIBLE 1000 6400 120000 73 OCENT, HERM, 25TG 11 100 WMT 1260 0610 16917 YES NO AVAILABLE POSSIBLE 1000 6400 120000 49 OCENT, HERM, 25TG 11 100 WMT 1260 0610 159007 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 120000 49 OCENT, HERM, 25TG 11 890 WMT 1260 0610 159007 YES NOT CONSIDER WAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 890 WMT 1260 0610 159007 YES NOT CONSIDER WAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 890 WMT 1260 0610 159007 YES NOT CONSIDER WAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 890 WMT 1280 107 OCENT, HERM, 25TG 11 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 107 OCENT, HERM 12 890 WMT 1280 1180 1180 1180 1180 1180 1180 1180	38000	SO CENT, OF EN	:		WAT	275.0	275.0		YES	FEASIBLE	CONVERT	POSSIBLE	0001	0400	00000		DETROEIT
35 CENT, HERM, 25TG 11 1550 WAT 2610 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 OCENT, HERM, 25TG 11 1550 WAT 260.0 560.0 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 OCENT, HERM, 25TG 11 1100 WAT 260.0 560.0 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 OCENT, HERM, 25TG 11 1100 WAT 126.0 DEAD 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 OCENT, HERM, 25TG 11 1100 WAT 126.0 DEAD 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 73 OCENT, HERM, 25TG 11 100 WAT 126.0 DEAD 24954 YES NO AVAILABLE POSSIBLE 1000 6400 120000 49 OCENT, HERM, 25TG 11 1800 WAT 126.0 DEAD 24754 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 1800 WAT 126.0 DEAD 24754 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 1800 WAT 126.0 DEAD 24754 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM, 25TG 11 1800 WAT 126.0 DEAD 24754 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM 12 600 WAT 126.0 DEAD 24754 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM 12 600 WAT 126.0 DEAD 24754 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 100000 49 OCENT, HERM 12 600 WAT 1000 1190 95705 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 100000 67 OCENT, HERM 12 600 WAT 265.0 DEAD 24505 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 95705 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 95705 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 95705 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 95705 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 9670 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 600 WAT 1000 1190 9670 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 90000 67 OCENT, HERM 12 800 WAT 1000 1190 9670 YES NOT CONSIDER AVAILABLE POSSIBLE 10000 6400 90000 67 OCENT, HERM 113 900 WAT 1000 1191 96705 YES NOT CONSIDER AVAILABLE POSSIBLE	36006	•	::	1050	TAW	584.0	490.0		YES	9	AVAILABLE	POSSIBLE	1000	6400	120000	1 6	FigCatha
37 CENT, HERM, 25TG 11 11500 WAT 560.0 560.0 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 93 CENT, HERM, 25TG 11 11500 WAT 560.0 560.0 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 93 CENT, HERM, 25TG 11 1100 WAT 560.0 150.0 560.0 224947 YES NO AVAILABLE POSSIBLE 1000 6400 120000 53 600.0 150.0 550.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0 1	39015	38 CENI, HERM, ZOLG	= ;	200	- V	624.0	490.0		YES	2	AVAILABLE	POSSIBLE	1000	6400	120000	6	FIGURE
99 CENT, HERM, 25TG 11 1729 WAT 260.0 560.0 529.47 YES NO AVAILABLE POSSIBLE 1000 6400 90000 73 90000 74 200.0 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT 260.0 188.1 7265 WAT	39015	37 CENT, HEHM, 2 S1G	= :	0271	× ×	0.150	0.00		VES.	S	AVAILABLE	POSSIBLE	1000	6400	120000	53	
82 GENT, HERM 1 50'G WAT 120'D DEMO 736 YES NO AVAILABLE POSSIBLE 1000 6400 65000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 80000 73 80000 73 80000 73 80000 73 800000 73 80000 73 80000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 800000 73 8000000 73 8000000 73 8000000 73 80000000000	39043	40 CENT, HERM, 2 STG	=	1250	WA	260,0	200.0		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Ş	AVAILABLE	POSSIBLE	1000	6400	120000	23	XE INOFIL
42 CENT, HERM 11 569 WAT 12840 DEMO 7360 YES NO AWAILABLE POSSIBLE 1000 6400 65000 57 60 KM 1280 DEMO 7360 YES NO AWAILABLE POSSIBLE 1000 6400 65000 57 60 KM 1280 WAT 128.0 DEMO 7360 YES NO AWAILABLE POSSIBLE 1000 6400 100000 49 60 KM 1280 WAT 128.0 1501.74 YES NO AWAILABLE POSSIBLE 1000 6400 100000 49 60 KM 1280 WAT 128.0 1201.74 YES NO AWAILABLE POSSIBLE 1000 6400 100000 49 60 KM 1280 WAT 128.0 10.0 1501.70 YES NOT CONSIDER AWAILABLE POSSIBLE 1000 6400 100000 49 60 KM 1280 WAT 128.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0 1	39043	HERM, 2	=	1100	WA	250.0	0.000	11000	2 2	2 2	AVAII ARI F	POSSIBLE	1000	6400	00006	73	REIMOFIL
46 CENT, HERM 11 300 WAT 125.0 DEMO 7360 YES FRASBLE CONVERT POSSIBLE 1000 6400 157 000 44 CENT, HERM 11 300 WAT 125.0 DEMO 7360 YES FRASBLE CONVERT POSSIBLE 1000 6400 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 10000000000	42000	42 CENT, HERM	Ξ	650	WAT	209.0	188.1			2 2	AVAIL ABI E	POSSIBLE	1000	6400	85000		RETROFIT TO 150 TON
4 CENT, PERM 11 300 WAT 125.0 306.0 7390 YES TANSINEL CONVERT POSSIBLE 1000 6400 100000 49 40 CENT, FERM 12 800 WAT 125.0 306.0 150175 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 40 CENT, FERM 12 800 WAT 122.0 24745 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 100000 49 1000000 49 100000 49 100000 49 100000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 1000000 49 10000000000	50004	45 CENT, HERM	Ξ	300	WAT	125.0	DEMO				CONIVEDT	POSSIBLE	1000	6400	25000	٠	CONV -10% CAP & EFF
4 CENT, HERM 2 TG 1 800 WAT 125.0 360.0 150775 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 140 CENT, HERM 2 TG 1 800 WAT 73.5 91.0 474.9 YES NOT CONSIDER POSSIBLE 1000 6400 100000 49 140 CENT, HERM 2 12 800 WAT 73.5 91.0 474.0 204754 YES NOT CONSIDER POSSIBLE 1000 6400 100000 49 140 CENT, HERM 1 2 800 WAT 73.5 91.0 474.0 280 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 807 WAT 110.0 119.0 96705 YES FEASIBLE CONVERT POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 807 WAT 210.0 153.0 115601 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 809 WAT 210.0 153.0 115601 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 809 WAT 210.0 153.0 115601 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 809 WAT 210.0 153.0 115601 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 809 WAT 210.0 153.0 115601 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 7 CENT, HERM 1 2 809 WAT 210.0 153.0 15501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 1 CENT, HERM 1 2 809 WAT 210.0 153.0 15501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 1 CENT, HERM 1 2 800 WAT 210.0 153.0 15001 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 1 CENT, HERM 1 2 800 WAT 210.0 153.0 15001 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 1 CENT, HERM 1 2 800 WAT 110.0 159.0 6705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO NO NO NO NO NO NO NO NO NO NO NO	50004	46 CENT OPEN	=	400	WAT	125.0	DEMO			FEASIBLE		DOSCIEL D	000	6400	85000	22	RETROFIT TO 150 TO!
48 CENT, HERM, 2 STG 11 880 WAT 436.0 474.0 204754 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 T PECHAL HERM, 2 STG 11 880 WAT 73.5 91.0 4764 YES NO AVAILABLE POSSIBLE 1000 6400 100000 49 T PECHAL HERM, 2 STG 11 880 WAT 73.5 91.0 48883 YES NOT CONSIDER NOT CONSIDER POSSIBLE NO DATA 500 NO DATA 4 CENT, HERM 12 607 WAT 110.0 119.0 96708 YES FEASIBLE CONVERT POSSIBLE NO DATA 500 NO DATA 110.0 119.0 96708 YES FEASIBLE CONVERT POSSIBLE NO DATA 500 NO DATA 110.0 119.0 96708 YES FEASIBLE CONVERT POSSIBLE NO DATA 500 NO DATA 110.0 119.0 96708 YES MOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 12 CENT, HERM 12 790 WAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 110.0 119.0 WAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 110.0 119.0 WAT 110.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 110.0 119.0 WAT 110.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO DATA 110.0 119.0 WAT 110.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO DATA 110.0 119.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO DATA 110.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO DATA 110.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO PART 110.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO PART 110.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO PART 110.0 119.0 119.0 96708 YES NOT CONSIDER AVAILABLE POSSIBLE 1000 6400 85000 67 NO PART 113 400 WAT 149.8 110.0 134199 YES NO AVAILABLE POSSIBLE 1000 6400 85000 67 NO PART 114 MAT 140.0 140.0 140.0 141.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0 140.0	50004	44 CENT HERM	=	300	WAT	125.0	306.0		YES	2	AVAILABLE	POSSIBLE POSSIBLE	000	6400	100000	49	RETROFIT
Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Value   Valu	00000	AD CENT HERM PSTG	=	880	WAT	436.0	474.0		YES	9	AVAILABLE	POSSIBLE	000	0040	10000	40	RETROFIT
2 RECIP-1         12 300 WAT 73.5         91.0         4883 YES NOT CONSIDER AVAILABLE POSSIBLE SOON DATA A CENT, HERM         12 300 WAT 128.0         107.0         72928 YES NOT CONSIDER AVAILABLE POSSIBLE NO DATA SOON NO DATA SOON NO DATA SOON NAT 110.0         119.0         96705 YES FEASIBLE CONVERT POSSIBLE NO DATA SOON NO DATA SOON NAT 110.0         119.0         96705 YES FEASIBLE CONVERT POSSIBLE NO DATA SOON NO DATA SOON NAT 110.0         115.00 VAT	07070	A7 CENT HERM 2 STG	=	880	WAT	512.0	474.0		- 1	2	AVAILABLE	_ \	1000	200	1		
CENT, HERM   12 680 WAT   228.0 107.0 72928 YES NOT CONVENT   POSSIBLE   POSSIBLE   FOSSIBLE   FO	1010	o RECIP.1	12	300	WAT	73.5	91.0	48883	-	TCONSIDER	AOI CONSIDER		•	000	•	•	NO RETROFIT
7 CENT, HERM 12 607 WAT 110.0 119.0 66705 YES FEASIBLE CONVERT POSSIBLE NO DATA 500 NO DATA 12 CENT, HERM 12 790 WAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO DATA 210.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 NO NO NO NO NO NO NO NO NO NO NO NO NO	200	A CENT HERM	5	680	WAT	228.0	107.0	72928	YES	T CONSIDER	AVAILABLE	POSSIBLE	•		ATAG ON	•	CONVERTINO RETROFIT
6 CENT, HERM 12 607 WAT 110.0 119.0 96705 YES FEASIBLE CONVENT POSSIBLE NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO SOO NAT 110.0 119.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE SOO SOO SOO NAT 110.0 110.0 96705 YES NOT AVAILABLE POSSIBLE SOO SOO SOO NAT 110.0 110.0 96705 YES NOT AVAILABLE POSSIBLE SOO SOO SOO NAT 110.0 110.0 96705 YES NOT AVAILABLE POSSIBLE SOON SOO SOON TO CONT, HERM, 25TG 113 415 WAT 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4 140.4	10.4	7 CENT HERM	12	607	WAT	110.0		96705	YES	FEASIBLE	CONVERI	POSSIBLE	ATAG CIA		NO DATA	•	CONVERT/NO RETROFIT
12 CENT, HERM 12 790 WAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 12 CENT, HERM 12 800 WAT 210.0 153.0 115501 YES NOT CONSIDER AVAILABLE POSSIBLE 500 12 CENT, HERM 12 800 WAT 210.0 240.0 133.099 YES NOT CONSIDER AVAILABLE POSSIBLE 500 13 CENT, HERM 12 1300 WAT 110.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 14 CENT, HERM 12 390 WAT 110.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 15 CENT, HERM 12 390 WAT 110.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 15 CENT, HERM 12 390 WAT 110.0 113.0 96705 YES NOT CONSIDER AVAILABLE POSSIBLE 500 15 CENT, HERM 12 500 WAT 227.5 227.5 131135 YES NOT CONSIDER AVAILABLE POSSIBLE 500 15 CENT, HERM 12 500 WAT 460.0 RETAIN NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 NO 296 N	2 5	A DENT LICEN	12	607	WAT	110.0		96705	YES	FEASIBLE	CONVERI	POSSIBLE	200			•	NO RETROFIT
12 CENT, HERM   12 F30 WAT 210.0 153.0 1155.01 YES NOTCONSIDER AVAILABLE POSSIBLE   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500   500	1 2	12 CENT HEBM	5	790	WAT	210.0	153.0	115501	YES	T CONSIDER	AVAILABLE	POSSIBLE	•	000	'	•	NO RETROFIT
2 CENT, HERM 12 680 WAT 215.0 240.0 133909 YES NOT CONSIDER AVAILABLE POSSIBLE 500 200 200 200 200 200 200 200 200 200	1000	MOUT HALO	5	790	WAT	210.0	153.0	115501	YES	T CONSIDER	AVAILABLE	POSSIBLE	•	000		,	NO BETROFIT
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1	00000	MULLINE TO CO	12		WAT	110.0		96705	YES	OT CONSIDER	AVAILABLE	POSSIBLE		200	•	•	NO RETROFIT
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APPENDIX M

Table M-2. Summary of Chiller Conversion and Retrofit Options (by Plant).

									E	OFF.							LL LL	L.											H.	LL.	1	Ļ										č	200	5 11			
Upgrade type					RETROFIT			NO RETROFIT	CONVERT/NO RETROFI	CONVERT/NO RETROFI		RETROFIT		RETROFIT	NO RETROFIT	NO RETROFIT	CONV -10% CAP & EFF	CONV -10% CAP & EFF	RETROFIT	RETROFIT	NO RETROFIT	NO RETROFIT	NO RETROFIT	NO RETROFIT	RETROFIT	RETROFIT			CONV -10% CAP & EFF	CONV -10% CAP & EFF	RETROFIT	CONV -10% CAP & EFF			***************************************	RETROFIL	Figorian	RETROPE	NO RETROEIT	DETROCIT	ו ייי	DETROCIT TO 150 TON	TELECTION 150 TELECT	CONV -10% CAP & FFF	RETROFIT	RETROFIT	
Upgrade/ Replace	cost			%	79 F			,	,			67 F	•	88		_	22	_		70	,	'	'		51 F	51			_			17 (				20				,					67		
ee Pe	Ü				85000	ı			ΤA	Ι¥		90006		85000			25000	25000	82000	85000	•		,	•	000	100000		1	29000	29000	10000	25000			' 6	0000	9 9	20000	3	' 000	3	, 000	85000	25000	00000	000001	•
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Rupt Disk Upgrade Upgrade & Hi Eff cost Replace	Purge	cost		₩.	6400	200	•	200	200	200		6400		9	200				6400	6400	200	200	200	200	9	6400	•	•				6400		•		355		0400									
Eddy	test	cost		49	1000	•	•	•	NO DATA	•	•	1000	•	1000	•	•	1000	1000	1000	1000	•	'	٠	•	1000	1000	•	•				1000	•	•		0001	_ ,	000		000+			200				
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## Appendix N: Proposed Master Plan for Chiller Upgrades

APPENDIX N

Table N-1. Recommendations for Implementing Chiller ECO's

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O _N	FOR CHILLER WORK	EXISTING CHILLER	CHILLER	COST	REBATE	_		COST	NEW UPGRADE	E MOVE	COST		COST P	PAYBACK C	COST	CHILLER CHILLER	$\supset$		ENERGY DRIVE PAYBACK	/E PAYBACI	3ACK
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41003 1.1	1 replace now	demolish		8542	3690	131135	149	150000													10.7
50001 1.1	1 replace now	demolish		9120	2424	139838		140284											2641 29979		11.4
91001 1.1	1 replace now	demolish		7936	2121	145030		151222													
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#### **Abbreviations and Acronyms**

A area

ARI Air-Conditioning and Refrigeration Institute

ANSI American National Standards Institute

ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning

**Engineers** 

ASME American Society of Mechanical Engineers

CFC chlorofluorocarbon
cfm cubic feet per minute
DOD Department of Defense

DOS Disk Operating System (Microsoft Corp.)

DPW Directorate of Public Works
DSM demand site management

ECO energy conservation opportunity
EDA energy disaggragation algorithm

EEAP Energy Engineering Analysis Program
EMCS energy monitoring and control system

°F degrees Fahrenheit

ft feet

G mass of refrigerant (pounds)

gal gallon

HAP Hourly Analysis Program (Carrier Corp.)

HCFC hydrochloroflourocarbon

HFC hydroflourocarbon

hp horsepower kW kilowatt

kW/ton kilowatt/ton of air conditioning

lb pounds

MEIP Model Energy Installation Program

NIST National Institute of Science and Technology

psig pounds per square inch gage Q flow rate of air (in cfm)

SERDP Strategic Environmental Research and Development Program

TLV threshold limit value UCS utility control system UN

**United Nations** 

USACERL

U.S. Army Construction Engineering Research Laboratories

**USEPA** 

U.S. Environmental Protection Agency

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